

AN ABSTRACT OF THE THESIS OF

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Abstract approved:



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There is a shortage of qualified community college technical instructors in new and emerging technologies. The purpose of this study was to investigate the barriers that may affect the decision of semiconductor specialists to teach part-time at community colleges. The desired outcome is to enable community colleges to increase the pool of part-time faculty from the semiconductor industry. This study identified four primary barriers that could affect an individual's decision to teach: (a) interest in teaching, (b) self-efficacy, (c) awareness of teaching opportunities, and (d) faculty development.

As community colleges seek to fill the increasing demand for part-time technical instructors, industry seeks to increase its ranks of technical employees. A survey of technical specialists from the semiconductor industry showed high levels of professional experience, interest in teaching, and various experiences in teaching. An important finding of this study, however, was the overwhelming lack of awareness (83%, n=76) of teaching opportunities at community colleges. If community colleges are to increase their pool of part-time technical faculty, it is necessary for technical specialists to be aware that part-time teaching positions are available. If industry is to fill its growing need for qualified technical specialists, it should be willing to share some of the talent of its best employees with the community.

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Barriers That Influence the Decision of Semiconductor
Specialists to Teach Part-Time at Community Colleges

by

David E. Smith

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Barriers That Influence the Decision of Semiconductor Specialists to Teach Part-Time at Community Colleges

1. INTRODUCTION

1.1 Statement of the Problem

There is a shortage of qualified community college technical instructors in new and emerging technologies. Faculty retirements, budget cutbacks, and program changes are among the reasons why community colleges are expected to replace more than 50% of their full-time faculty within the next five years (O'Banion, 1994). While there is an abundant supply of replacements in an area such as liberal arts, there are current and projected faculty shortages of qualified instructors in many areas of occupational education. This is especially evident in emerging technologies, such as the semiconductor industry. Because of the technical expertise needed in emerging technologies, it is difficult to hire enough instructors to produce sufficient numbers of qualified operators, technicians, and engineers to meet the growing needs of the semiconductor industry. Not only must community colleges meet the current demand for technical instructors, they must also increase the pool of these technical specialists to meet anticipated future demand (Biles & Tuckman, 1986; Roueche, Roueche, & Milliron, 1995).

The semiconductor industry provides a rich resource for potential technical part-time instructors. Technical specialists employed in this industry have current skills that are necessary to compete in the marketplace, an important factor in recruiting qualified instructors. However, faculty recruitment is a complex process. Before administrators make staffing decisions, they must consider many variables: faculty retirements, budget cutbacks, institutional philosophies, labor contracts, changes in enrollments, topical relevancy, content knowledge, flexibility, and the appropriate use of part-time faculty.

Because of the specialized nature of occupational education, community colleges must carefully evaluate the use of part-time instructors. However, many community college educators do not agree on the extended use of part-time faculty and the debate continues over the appropriate use of this important resource. Data from the Office of Educational Research and Improvement (Mayville, 1989) suggest that the employment of part-time faculty will continue to increase, with a continuing demand to provide relevant occupational programs. Many community colleges will respond by trying to locate and hire occupational specialists who can become effective part-time faculty members. These specialists from business and industry can help fill the gap left by retiring faculty and become instructor candidates for teaching emerging technologies. The problems that arise from staffing such positions, however, are just as multifaceted and complex as the larger part-time staffing controversy itself.

1.2 Purpose of the Study

The purpose of this study was to identify barriers that may influence the decision of semiconductor specialists to teach part-time at community colleges. With barriers of interest in teaching, self-efficacy, awareness of teaching opportunities, and faculty development being identified, community colleges can use the results of this study to overcome these barriers and thereby increase the pool of part-time technical faculty members.

1.3 Background and Setting

The connections between the workplace and the community college are a major concern for our society (Blai, 1976; Bragg, Hamm, & Trinkle, 1995; Vaughan, 1995).

Driven by the demand for technicians and craftsmen since World War II, community colleges have responded to the challenge of providing a qualified workforce. Although current proposed budget rescissions for government aid threaten successful implementation of occupational programs, the U.S. Labor Department predicts that by the end of the 1990s an estimated 73% of all U.S. jobs will require some form of postsecondary education for job entry. Since a major role of the community college is to help produce a skilled workforce, this institution will continue to play a major role in training and retraining workers for the 21st century. Moreover, the role of preparing workers will be influenced by how much workforce training business and industries are willing to do and how much they delegate to community and proprietary colleges (Vaughan, 1995).

Because of deregulation, global competition, and rapid growth in technology, employers must be more selective and more demanding by hiring employees with superior qualifications (Carnevale & Schulz, 1989; Gianini & Sarantos, 1995). However, Crockett (1995, January 27) cautioned that although effective development of qualified technical employees is a key factor in realizing America's advantage in the world's economy, there is a shortage of instructors in technical education and training. An increase in technical instructors will enable community and technical colleges to continue their important role in training, retraining, and educating a rapidly changing workforce (Kantor, 1991; McLaughlin, Bennett, & Verity, 1988; U.S. Department of Labor, 1987). This rapidly changing workforce is especially evident in the semiconductor industry. The semiconductor industry and community colleges view faculty shortages as a barrier to staffing an adequate semiconductor workforce. Both sectors concur that there is difficulty in recruiting and hiring qualified microelectronics, electronics, and operator training instructors (Semiconductor Workforce Consortium, 1995).

The increasing demand for specialized instructional services, coupled with declining financial resources, makes it unrealistic for community colleges to realize this

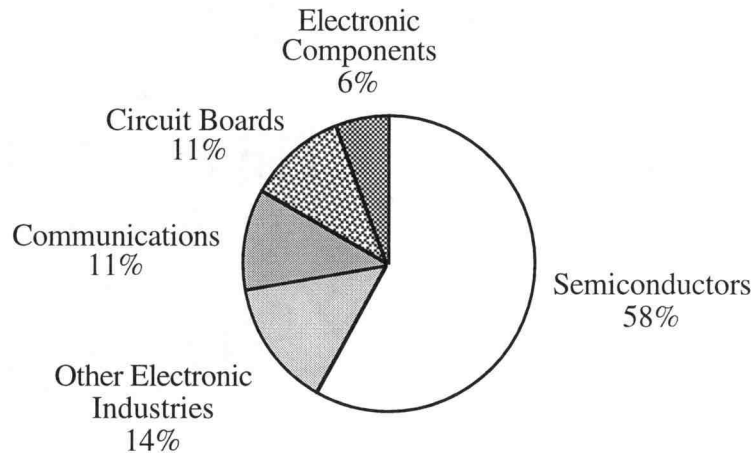
occupational preparation mission without employing part-time faculty (Lankard, 1993; Miller, 1992). Fields in high technology (high-tech) are particularly affected by faculty shortages. Vaughan (1995) suggested many part-time faculty bring expertise to a community college that may not be available from full-time faculty. There are few people qualified for high-tech faculty positions and the competition for this scarce talent comes from business, industry, and government (Gappa & Leslie, 1993). Furthermore, Blai, (1976) suggested that another concern for occupational education is the need to be flexible in staffing, scheduling, and resources.

Employers are concerned that neither parents nor schools are adequately preparing young people for the world of work. For example, according to 85 Oregon employers surveyed in a statewide study, only 5% to 30% of young job applicants are adequately prepared for work. Employers' expectations and needs far exceed students' skills (Crockett, 1995). This gap becomes wider as occupations become more integrated with technology. Emerging technologies, such as semiconductors, electronic components, circuit boards, communications, interactive media, and computer-dependent manufacturing processes require sufficient skills to meet employer expectations. In 1993, the Oregon Employment Department (as cited in Semiconductor Workforce Consortium, 1995) reported high-tech employment at 44,822, with the distribution as shown in Figure 1.1.

However, while the demand for employment increases, technological demands within the semiconductor industry are causing many companies to raise the skill level requirements for entry-level work. Because of increased automation, some manufacturers indicate that they are already moving away from lesser skilled operator positions to those positions requiring higher skilled technicians (Semiconductor Workforce Consortium, 1995).

As high-tech industries require higher levels of skill, community colleges must secure qualified instructors to meet the dynamic needs of these industries. Locating and

Figure 1.1 Oregon Employment in the Electronics Industry, 1993



recruiting such instructors is a continuing challenge for both industry and community colleges (Semiconductor Workforce Consortium, 1995). As the semiconductor industry accounts for 58% of the electronics industry employment in Oregon, it is important to examine barriers that may influence the decision of potential technical instructors to teach part-time. For example, aspiring technicians and engineers normally prepare for a full-time career in the semiconductor industry through established academic or occupational training. At the completion of this formal training technical specialists do not have the necessary experience to qualify as part-time teachers (Miller, 1979; California Community Colleges Academic Senate, 1989). Therefore, it is unlikely that new graduates in technical fields consider teaching part-time at community colleges. New technical specialists must gain experience on the job and learn how to successfully apply their skills in the marketplace before they consider teaching.

1.4 Statement of Theoretical Framework

Other factors arise that may influence the decision of experienced technical specialists to teach part-time. For example, after they have gained experience on the job, do they perceive themselves as possible candidates for teaching their skills to others? Do they want to teach part-time at a community college? Can they assume the role of teacher? Does self-efficacy, or their belief in their ability to teach, influence such a decision? Will a community college hire them, even if they are qualified?

An important component in making the decision to teach part-time is how one's beliefs or expectations influence that decision. To better understand the importance of making a decision to teach part-time, this thesis examines the theoretical framework of self-efficacy. The term *self-efficacy*, in the context of this thesis, describes the beliefs of technical specialists in their ability to teach. This framework draws upon an integration of Bandura's (1977) seminal work on self-efficacy and Hackett and Betz's (1981) adaptation of Bandura's theory to career development. Occupational specialists view their skills with their application in the workplace, but they may not feel as competent in the role as part-time instructors. A careful examination of self-efficacy in extending one's career into teaching may enable researchers to better understand this trait as an influence on technical specialists as they consider teaching part-time for a community college.

Technical specialists from the semiconductor industry are the source for data, conclusions, and implications for this thesis. The following premises of the self-efficacy theory (Bandura, 1977; Hackett & Betz, 1981; Lent, Brown, & Hackett, 1994; Mager, 1992; Prickel, 1994) are randomly listed and provide the theoretical support and methodological direction for identifying self-efficacy as one barrier to technical teaching.

1. Factors of attention, expectancies, and beliefs play an important role in the acquisition of new behavior.

2. People who perform poorly may do so because they either lack the skills or have the skills, but lack the efficacy to use them.
3. Self-efficacy influences choice of activities, the amount of effort expended, and persistence in the face of obstacles.
4. Self-efficacy has been proven to be a better predictor of success in the performance of an activity than actual innate ability.
5. Self-efficacy is a construct found effective in altering avoidant behaviors.
6. Self-efficacy is applicable to other disciplines of human behavior.
7. The theory of self-efficacy is best applied to domain-specific contexts, such as making the decision to extend one's career from the technical workforce to teaching those same skills to others.

1.5 Definition of Terms

Implicit in the discussion of part-time faculty in occupational education is the necessity of clarifying terms. The following definitions apply to this study:

Associate's Degree. "An award that normally requires at least 2 but less than 4 years of full-time equivalent college work" (National Center for Education Statistics, 1992, p. 2).

Full-Time Faculty. "The teaching staff . . . whose positions require them to be on the job on school days throughout the school year, or at least for the number of hours the institution is in session" (Shafritz, Koeppe, and Soper, 1988, pp. 190, 205).

Occupational Certification. "Also called certification. The process that permits practitioners in a particular occupation to claim minimum levels of competence" (Shafritz, Koeppe, and Soper, 1988, p. 325).

Occupational Education. A term sufficiently broad to include all areas of study, such as technical and trade training, nursing education, and secretarial training. Best used to denote all organized community college programs of study that prepare students for employment upon the successful completion of that program (Grote, 1977).

Occupational Program. “A program of study consisting of one or more courses designed to provide the student with sufficient knowledge and skills to perform in a specific occupation” (National Center for Education Statistics, 1992, p. 15).

Part-Time Faculty. “[Faculty] who occupy positions that require less than full-time service. This includes those employed full-time for part of the school year, part-time for all of the school year, and part-time for part of the school year” (Shafritz, Koeppel, and Soper, 1988, p. 340).

Recruitment. “. . . the process of attracting qualified applicants for existing or anticipated job openings” (Rothwell & Sredl, 1992, p. 74).

Self-Efficacy in Career-Decision. The belief that one can successfully perform within a specific career domain (Hackett & Betz, 1981).

Technical Education. Preparation for occupations within scientific and engineering fields where students receive a concentration of science and math. It stresses the use of instruments rather than the use of tools. It suggests mental effort rather than muscular exertion, including more depth of understanding and allowing for more independence in judgment (Grote, 1977).

2. LITERATURE REVIEW

2.1 Summary of Literature Review

The review of literature provides information on how barriers affect the decision of technical specialists in the semiconductor industry when considering teaching part-time at community colleges. Internal barriers, such as interest and self-efficacy, and external barriers, such as awareness of teaching opportunities and faculty development are examined. This review explores the nature and scope of technical teaching at the community college and explores the workforce needs of the semiconductor industry. It also addresses the theory of self-efficacy and its application to decision-making as technical specialists consider teaching part-time.

2.2 Demographics of Part-Time Occupational Faculty

One of the great challenges that America now faces is the ability to educate and employ an increasingly diverse population in a shrinking and rapidly changing global society (Carter, 1994). O'Hare (as cited in Carter, 1994) elaborated on the challenge by suggesting that our society is undergoing a transition from a predominantly white population rooted in Western culture to a society composed of people from diverse racial and ethnic backgrounds. Equitable demographic representation in occupational education is difficult to address without knowing the demographics of current part-time faculty members. Despite the high numbers of part-time faculty members, particularly in occupational and technical programs, Bartow (1990) and Lombardi (1975) suggested administrators know very little about these faculty as a group.

The 1988 National Survey of Postsecondary Faculty, sponsored by the National Center for Education Statistics, described respondents representing a variety of disciplines who taught part-time at public two-year colleges:

1. As a group, they were younger than full-time faculty, with a mean age of 44 years for part-time versus 47 years for full-time.
2. About one-half (52%) of part-time faculty had other full-time employment.
3. Representation of racial and ethnic minorities was slightly less than among full-time faculty (8% versus 9%).
4. Employment by gender reflected 61% men, 39% women.
5. There were many instances of dual-career academic couples in which one partner assumed part-time status to accompany a full-time spouse.
6. The majority had at least a master's degree and many had extensive work experience. Many chose teaching over pursuit of a higher degree in mid-career.
7. Served their institution(s) over widely varying lengths of time, with means for part-time at 6.1 years and 12.3 years for full-time.
8. Chose to teach for a variety of intrinsic and extrinsic reasons.

These demographics, however, suggest generalized characteristics of the entire part-time faculty at community colleges and are not necessarily indicative of technical specialists who teach part-time. Bartow (1990) reported that the profiles of technical and occupational part-time faculty from Prince George's Community College (PGCC) in Maryland closely resembled employment profiles collected by PGCC's personnel office. This suggests that the respondents represent the general population of part-time faculty at the same institution, at least with age, gender, degrees, and experience. Among technical and occupational part-time faculty at PGCC, the mix of academic attainment was 12% doctorates, 70% masters, and 18% with bachelor's degrees or less.

Although there may be several ways to classify part-time instructors, Marsh and Lamb (1975) and Vaughan (1986, 1995), maintained that there were two primary categories of part-time faculty at two-year colleges:

1. Independents. This group teaches for personal reasons, such as ego-satisfaction, the desire to function as a good citizen, or simply out of a desire to share the state of their profession by educating others. Their livelihoods, social, and professional lives are independent of their part-time teaching positions. Independents include:
 - a. Those who prefer to continue part-time employment at the community college.
 - b. Full-time instructors who accept extra-pay assignments.
 - c. Expert professionals who bring special service to a particular and infrequent class assignment.
2. Dependents. This group is dependent upon part-time teaching because it may eventually lead to full-time employment within that, or other institutions. This group also includes those who are dependent upon part-time teaching for monetary reasons. Dependents include:
 - a. High school teacher who wants to teach at the community college.
 - b. Part-time itinerants who must teach at several institutions to obtain a living wage.
 - c. Part-time teacher with another part-time job other than teaching.
 - d. Otherwise unemployed part-time teacher.

However, Marsh and Lamb (1975) concluded that many part-time faculty in community colleges are not necessarily temporary employees. For example, results from their 1972 survey of part-time faculty at Bellvue Community College suggested that teaching part-time was the only source of income for many respondents. At Monterey Community College, survey results indicated that over one-third of the part-time faculty

had taught continuously for over six years. Marsh and Lamb concluded that part-time faculty often found themselves doing part-time teaching on a full-time basis. They accomplished this by accepting as many courses as possible when offered by a single institution, or they traveled to other community colleges to complete their teaching circuit.

For part-time faculty possessing special skills, such as those found within occupational education, Williams (1972) reported that many enjoy teaching one or two classes during the evening. They are not interested in institutional governance, but their satisfaction comes from being associated with a collegiate institution and performing in an occupation that still commands respect from a large segment of the community. In addition, they find particular satisfaction in sharing their special talents with others.

2.3 Historical Perspectives on Occupational Part-Time Faculty

Although contemporary educators support the use of part-time instructors, the use of part-time faculty is not a new phenomenon (Spinetta, 1990). Eells (1931) reported in 1921-22, 91% of the staff in eight California junior colleges taught part-time and in 1928-29, 52% of the instructors in Texas municipal colleges taught part-time.

As early as 1925, Prosser and Allen wrote about the difficulties of producing and securing instructors in vocational education. Because of the specialized nature of occupational training, they felt that it was impractical to employ permanent instructors. If instructors are employed and released as specific demands appear, the only way to meet this situation is to draw instructors from the occupations themselves.

A hotly debated issue arose in determining who should train and supply vocational instructors. Prosser and Allen maintained that collegiate institutions are incapable of producing effective instructors for trades and industry (Evans, 1988). Prosser's negative

view of collegiate preparation strengthened when he stated that colleges were likely to produce instructors who were occupationally inadequate (Prosser & Quigley, 1950).

Rogers (as cited in Evans, 1988) offered an opposing view of vocational teacher training. Rogers posited that vocational teacher training by state departments of vocational education could do little more than provide the skilled worker with a few teaching devices. It was therefore necessary to provide resident teacher training at collegiate institutions to prepare vocational teachers with broader training that included general subjects along with related technical subjects.

A third view was that neither colleges nor state departments of vocational education could do the job of teacher training. Large urban school districts should train their own vocational teachers (Evans, 1988). However, in a classic work on the junior college, Eells (1931) discussed how and why two-year schools might find it advantageous to use part-time faculty. Suggestions included drawing on the expertise of members the community with special skills; using full-time faculty from nearby universities on a part-time basis; and employing local high school teachers who could offer continuity between high school and junior college programs. Eells indicated such resources could provide better teaching than might otherwise be available, moreover establishing considerable variety in the curriculum. Bragg, et al. (1995) supported earlier conclusions by Eells (1931) and Prosser and Allen (1925). Many full-time faculty lacked sufficient interest and knowledge about specific areas of occupational and technical education because they failed to keep up with the current demands of industry.

When colleges want to supplement or enrich the curriculum by offering courses that do not ordinarily require the continuous services of a full-time faculty member, part-time faculty are then called upon to complete the faculty roster. The most frequently desired part-time faculty members are specialists, rather than generalists. Community colleges prefer employing specialists who complement the strengths of full-time faculty and enrich the curricular offerings (Thompson, 1984).

The role and perception of the part-time instructor have evolved over the past three decades. Before 1970, institutions viewed the typical part-time instructor as an expert community resource who could provide program specialization, enhancement, and flexibility to the benefit of the institution, its students, and its full-time faculty. By the late 1970s, increasing numbers of part-time faculty became seen as a source of inexpensive labor, rather than a valuable resource (Kekke, 1983). Granting that widespread and growing use of part-time faculty is a result of efforts to cope with financial difficulties, the use of part-time faculty has perhaps shifted to a newer financial strategy. As postsecondary collective bargaining increases throughout the country, it is possible that recruitment of part-time faculty also discourages collective bargaining due to the factionalization of this teaching resource (Marsh & Lamb, 1975).

In order to meet the challenge of global competition and exponential technological advances since World War II, community and technical colleges have played an important role in training, retraining, and educating a rapidly changing workforce (Kantor, 1991; McLaughlin, Bennett, & Verity, 1988; U.S. Department of Labor, 1987). Initially, the federal government helped support this workforce by implementing the Vocational Act of 1963, amendments to the Vocational Act in 1968 and 1972, and the Carl D. Perkins Act of 1984 with its later reauthorizations (Vaughan, 1995). Current funding, however, provides fewer resources for community colleges while the demand for training, retraining and educating students to become productive members of the American workforce continues to grow.

Regardless of the funding dilemma, Vaughan (1995) stressed the importance of technical education in today's society. Many organizations regard a well-trained workforce a vital asset for providing a competitive edge as our society strives to meet the demands of competition. Many employers are raising their educational and training requirements at an unprecedented rate. Increasingly, two-year colleges have become involved in occupational education, but data suggest a modest decline in this area. For

example, In 1985, 72% of community college students received associate degrees in professional/technical fields. In 1990, 66% of the students received associate degrees specializing in professional/technical fields. The percentage of graduates from certificated programs, however, was not reported (Stern & Chandler, 1987; U.S. Department of Education, 1993).

Because of the economic and social challenges that community colleges encounter, the use of part-time faculty has consistently increased in American community colleges. Employment trends recorded between 1987 and 1989, show that 41% of community colleges increased their hiring of part-time faculty. Between 1990 and 1992, that number increased to 60% (Hawkins, 1993). Vaughan (1995) reported that there were approximately 1,472 public community colleges, technical colleges, two-year branch colleges, and independent junior colleges in America. Approximately 1,300 of these institutions were public, with more than 5.7 million students enrolled in credit courses.

Graduates with specialized associate degrees depend upon their knowledge and skills to compete in a marketplace driven by supply and demand; faculty shortages in occupational education generally affect the supply of workers in the marketplace. As the American workforce tries to keep pace with global competition, workers must train and retrain to keep up with the changing demands for new specialized skills (Kantor, 1991). Because of the harsh realities of global competitiveness and economic constraints, Cohen & Brawer (1996) found that occupational education continued to be an important factor in responding to the needs of the individual and to society. They further stated that the traditional values of a liberal education have become subordinate to “. . . job getting, job certifying, [and] job training” (p. 28).

To help meet the needs of employment procurement upon graduation two-year institutions are being called upon to implement work-based learning programs. These programs should interact with manufacturing and high-tech industries. However, Bragg, Hamm, and Trinkle (1995) found a conspicuous lack of formal training programs that

linked manufacturing and high-tech programs to work-based learning at two-year colleges. They suggest that such programs are critical to manufacturing while work-based learning would appear to enhance student understanding of associated occupations.

While striving to provide quality programs in technical education through work-based learning, another challenge arises. Just as community colleges brace for economic cutbacks, they are faced with dramatically increasing enrollments. As the twenty-first century approaches, many educators view this challenge with skepticism and caution. Gappa and Leslie (1993) and Miller (1992) suggested that this challenge is further heightened as community colleges reevaluate their academic infrastructures in response to the needs of their communities.

Economic and staffing dilemmas particularly affect smaller community colleges located in rural or isolated areas. As their financial support erodes and faculty shortages increase with the retirement of many full-time faculty hired in the 1960s, these institutions are often unable to effectively staff their classrooms. Furthermore, business and industry often recruit qualified graduates out of teaching careers. This contributes to faculty shortages and further exacerbates the shrinking pool of qualified faculty (Chatman & Jung, 1992; Guthrie-Morse & Julian, 1989).

Although several institutions offer programs in community college leadership, offering career resources, few institutions offer help in finding a community college teaching positions for discipline-based doctoral students. Few applicants specifically prepare to teach in community colleges; even fewer prepare in programs built upon a definitive teaching/learning paradigm (Engleberg, 1993). Few areas of specialized occupational preparation can be any stronger than the foundation of general education upon which it is built. Furthermore, few educational programs can be any stronger than the instructor. Community colleges will continue to hire part-time faculty because graduate institutions typically do not prepare their students to fulfill the instructional needs of the community college (Reed, 1967).

Engleberg (1993) noted that employment opportunities are greater in occupations that require advanced levels of both general and special education in manipulative skills and technical knowledge. This suggests that occupational instructors in the future will require greater degrees of competency compared to instructors in the present or the past. Engleberg further suggested that community colleges will continue replacing full-time faculty from the ranks of experienced part-time instructors, rather than hire new instructors from pools of applicants from graduate school. This reasoning, however, appears too simplistic. It does not consider the many factors involved in using faculty on a part-time basis. Furthermore, it does not account for difficulties in recruiting qualified applicants to teach specialty classes found in occupational education.

Although faculty shortages are becoming common in occupational fields, it is still necessary to be selective in recruiting a candidate as a part-time instructor in occupational education. (Cohen, 1969; Rothwell & Sredl, 1992; Thornton, 1960). Roueche, et al. (1995) stressed the importance of keeping up-to-date in occupational programs through effective part-time faculty recruitment:

Not only must the majority of colleges put more effort into finding qualified individuals who wish to teach part-time, they must pay special attention to hiring individuals who have the credibility and experience that industry and business respect and expect, who can demonstrate a keen ability to maintain instructional standards upon which the college stakes its reputation in the community, and who can provide students with high quality instruction that meets accepted industry needs (p. 44).

Historically, the process of full-time faculty recruitment in two-year postsecondary institutions has been an important component of effective staffing since the inception of the junior college model. But administrators must review and revise hiring policies of part-time faculty. Part-time faculty are often hired at the last minute by administrators without consulting the full-time faculty in the department and the position is rarely advertised (Hartleb & Vilter, 1986). Roueche, et al. (1995) reported that the common strategies for recruiting, selecting, and hiring part-time faculty used more than a decade

ago has undergone few changes. Unfortunately, the procedures hiring of part-timers are still less formal, less rigorous, and less advertised than those for full-time faculty.

It is especially difficult to secure qualified applicants to teach technical components in occupational and technical fields. Traditional methods of recruitment may not work adequately for occupational specialists. Often, these specialists are busy at their full-time employment and may not be interested in teaching, or they may not even be aware that teaching opportunities exist. Parsons (1980) cautioned institutions to move from a passive role of newspaper ads or job postings to an active role of individual contact in recruiting the best part-time faculty available.

Other recruitment problems arise. Too many colleges wait until an emergency arises rather than make systematic efforts to recruit qualified part-time faculty in advance. It is also difficult for full-time instructors to keep up with the advances in their field. According to Bishara, King, and Lotito (1989), new and emerging technologies, such as the semiconductor industry, have a knowledge half-life of three years. Magee (as cited in Allen, 1995) suggested this progression of knowledge is accelerating. The Semiconductor Workforce Consortium (1995) elaborated when they stated that this dramatic industry growth is attributed to ever-changing technology. Semiconductors provide microelectronic devices in everyday lives. Chips are no longer meant only for computers; today, chips are critical components in a wide variety of products for the home, office and car.

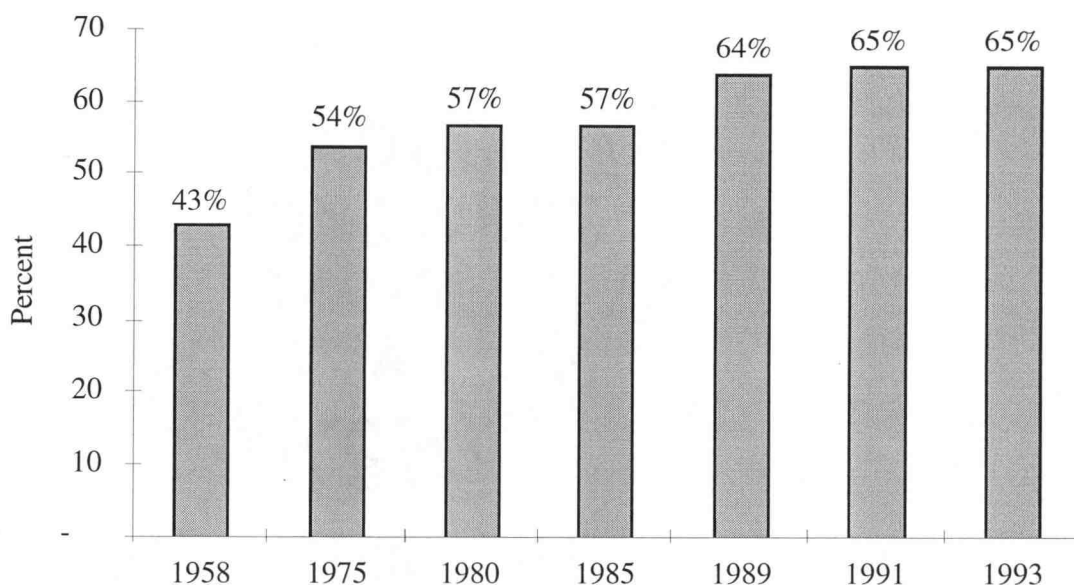
To keep pace with such a dramatic increase in knowledge, community colleges must rely on the part-time faculty to keep up with advances in technology. Many industry specialists are ideally suited to teach part-time, since they are involved with the leading edge of such advances. A dilemma arises when social, cultural, and political influences affect administrative and technical faculty decisions. Bishara, et al. (1989) suggested there is a two-tiered society of administrators and technical faculty that influence educational outcomes. The first tier includes faculty members from urban

community colleges with proactive leaders who encourage and enable their faculty to learn about the new technologies through various types of faculty development. The second tier includes faculty from colleges whose administrators consider technical courses to be a disposable liability. For example, it is less troublesome and expensive to staff and equip a writing lab than it is to staff and equip a semiconductor lab for technicians. Barring local interventions, these colleges slide into technological mediocrity and eventually extinction in their technical offerings.

Because of the technological demands of business and industry, Mayville (1989) suggested that there is an increased need for assessment and accountability. This would foster the quality education programs demanded by business and industry. As community colleges respond to the needs of business and industry, they must recognize that skill requirements will surely change as many occupations evolve, while others become obsolete. Such recognition is vital in attaining accurate program assessment and accountability.

Community colleges now employ more than 100,000 full-time faculty and approximately 190,000 part-time faculty (Vaughan, 1995). Burton and Celebuski (1995) reported the National Science Foundation estimates that 11,700 faculty teach engineering technology in 725 of the nation's 1,325 two-year colleges. Approximately 42% are employed as part-time faculty. However, the American Association of Community Colleges (1960, 1975, 1981, 1986, 1991, 1993) reported a more dramatic use of part-time faculty. These percentages of part-time instructors represented all disciplines and were employed at public community colleges in the United States as shown in Figure 2.1. Data are presented for public community, technical, and junior colleges, exclusive of U.S. territories, possessions and the Community College of the Air Force. In the pacific northwest, the use of part-time instructors is even greater, approaching approximately 75% (Stern, 1993).

Figure 2.1 Percentage of Part-Time Faculty at Community, Technical, and Junior Colleges



Source: American Association of Community Colleges: Annual Fall Surveys 1960-1993

The projected need for increasing faculty in occupational education is further complicated by the retirement of full-time community college instructors hired in the expansion period of the 1960s (Baker, Roueche, & Gillett-Karam, 1990; Engleberg, 1993; Higgins, et al., 1994; Parsons, 1992). Estimates of faculty retirements vary, but Baker, et al. (1990) suggested the retirement rate will be approximately 50% of full-time instructors within the next five years. O'Banion (1994) suggested over 50% of full-time faculty will retire within four years. Many of these retirements, however, may not be permanent. The American Association of Community Colleges (Li, 1995) found that 55% of those intending to retire would like to retire and continue to work on a part-time basis.

Predicting retirement rates is problematic, however, because some institutions encourage earlier retirement while others encourage longer careers. Regardless of the

retirement rate, Baker, et al. (1990) posited as retirement rates increase, so will the use of part-time instructors. Harris (1980) suggested there is difficulty in recruiting and deploying part-time faculty members. Colleges are struggling to identify and implement models that are capable of providing a systematic, rational, and continuous program of part-time faculty recruitment. Across the nation, community colleges are suffering from a lack of administrative expertise to effectively attract, hire, and retain qualified part-time faculty members. Research can assist colleges in making more rational efforts in this area.

2.4 Reasons for Employing Part-time Faculty in Occupational Education

Arguments in favor of using part-time faculty center on two points (Vaughan (1986):

1. Part-time faculty bring greater flexibility to the curriculum.
2. Part-time faculty are less expensive than full-time faculty.

Occupational education continues to be a vital factor in the nation's economic fabric. To fill workforce demands, it is necessary for community colleges to recruit qualified occupational specialists as part-time faculty members. Kuhns (1971) suggested community colleges could not offer the wealth and variety of programs were it not for part-time faculty members.

In attempting to keep up with the technical component in occupational and technical fields, the use of part-time faculty is an attractive enhancement to occupational and technical programs (Wallace, 1991). The use of part-time faculty are ideal as teaching resources. They can teach evenings, weekends, off-campus, and offer the advantages of lower cost-per-credit, linkage to a particular industry, and a supposed superiority in

expertise (Bishara, et al., 1989). Friedlander (1980) suggested flexibility in applicants for part-time faculty positions also allows community colleges to be flexible in class scheduling and curriculum. Community colleges can hire faculty with special skills for specialized courses that the full-time faculty are not prepared to teach. Administrators can schedule classes in off-campus locations during evenings and week-ends. Part-time faculty can staff courses where success in terms of enrollments is uncertain, thus providing administrators with the option of canceling the courses and the instructors' contracts at little or no cost to the college.

Since part-time faculty are not provided security of employment or tenure, colleges can hire or fire part-time faculty as a means of responding to sudden shifts in student interests, enrollments, and allotted funds for community college education. As community colleges in America face the challenges of budget retrenchment and difficulties in accurately predicting future enrollment patterns, these institutions can gain substantial benefits by hiring effective part-time faculty members. Part-time faculty provide considerable cost savings, bring business and technical expertise to the faculty and allow administrators to try new programs without making long-term commitments to new, full-time faculty (Munsey, 1986).

The use of part-time faculty in occupational education fills both purposes of flexibility and cost-cutting mandates (Lankard, 1993; Lombardi, 1975; Marsh & Lamb, 1975; Parsons, 1992). However, community colleges must consider how part-time instructional staff will be used in light of limited resources, institutional needs, and accelerating technology (Brown, 1982; Dunlap, 1986; Miller, 1987). Administrators can exercise their prerogative of short-term commitment by hiring part-time faculty for no more than an academic term (Hartleb & Vilter, 1986). Many part-time faculty are also willing to teach off-site classes and classes held at unusual hours. This gives the institution flexibility that allows a program to adjust to shifting enrollment and expand its outreach.

Eliason (1980) also stressed the importance of flexibility, arguing that part-time faculty, hired on a short-term or ad hoc basis, could help institutions respond to changing educational needs. The adult who turns to the community college for job training and career certification needs instant service. Community colleges must be ready to provide work skills to match the changing requirements of the job market. A static faculty, however, cannot provide this. Furthermore, when community colleges hire local citizens as part-time instructors, college relations improve with the community and program flexibility increases (Hammons, as cited in Palmer, 1986). Part-time faculty in occupational specialties provide an important link to local businesses, industries, government, and community organizations (Eliason, 1980).

Community colleges find that the extensive use of part-time instructors from industry helps to fulfill the needs for maintaining current, relevant training programs in new and emerging occupations. The rationale for using part-time faculty in occupational education so extensively is: (a) to bring real-world vocational expertise to community colleges by maintaining current, relevant training programs in new and emerging occupations, (b) to provide training programs on an occasional, on-demand basis, and (c) to offer ongoing programs for low enrollments. Some reasons for the increased demand for part-time faculty include greater demand for education by adults, increased interest in nontraditional, noncredit education, and changes in workforce structure (Miller, 1983). Biles and Tuckman (1986) summarized the use of part-time instructors by stating that the use of this resource enables institutions to enrich classroom instruction, build bridges to the local community, and be flexible toward unexpected social and economic changes.

The role of part-time occupational faculty becomes greater as the workforce proceeds into an age where there are so many demands for specialization. Cline (1993) suggested community colleges could increase student learning by inviting the industry professional to become involved in the planning process. This is an effective strategy as

occupational specialists interact with experienced part-time technical faculty; thus providing planning for the current or future needs of manufacturing. It also provides an opportunity for occupational specialists for future teaching invitations.

According to Bartow (1990), the effective use of part-time faculty represents an opportunity, rather than a threat. For example, by the year 2000, Prince George's Community College (PGCC) expects to complete a strategy for the reduction of full-time faculty. This strategy began in 1990 beginning with 35% part-time instructors. By the turn of the century this figure will increase to 50%. Although initially driven by economics, PGCC's reason for increasing part-time faculty evolved into a strategic plan. It used the savings from unused full-time salaries to fund a comprehensive program of full- and part-time faculty development. Bartow suggested this strategic plan would be an important factor in the development of effective faculty members. The plan will also enable administrators to run the institution more efficiently and with greater flexibility.

Harris (1980) indicated that one of the most impressive features of the community college has been the use of part-time faculty. They bring to the college a diversity of experience that usually is not found in a full-time faculty, especially true in the business and industrial areas. Part-time faculty members can offer up-to-the-minute observations to students who will soon be competing for jobs in the marketplace. They also represent enrichment, diversity, scheduling flexibility, short-term contractual obligations, and a degree of economic savings. However, to realize these goals, administrators must maintain responsibility for recruitment, evaluation, and retention of effective part-time faculty members.

Beyond the advantage of lower cost and greater control, Lombardi (1975) suggested that part-time instructors provide institutions with a wealth of talent and experience by individuals who do not want full-time assignments. With declining enrollments or financial limitations part-time instructors could be terminated with little difficulty, thereby protecting tenured instructors. Part-time instructors would also make

it easy to staff specialty classes that rarely have enough students to justify full-time instructors.

2.5 Arguments Against the Excessive Use of Part-Time Faculty

Arguments against the use of part-time faculty also center around two points Vaughan (1986):

1. Part-time faculty detract from the collegiate nature of the institution in institutional governance, committee work, and faculty interaction with students.
2. Part-time faculty make it possible for administrators to fill nearly all new and vacant positions, thereby reducing the number of full-time faculty members, thus weakening the power base of the full-time faculty.

There is little debate when community colleges use part-time faculty reasonably and appropriately. However, there is great concern over the excessive or inappropriate use of this resource. For example, when administrators maintain a temporary teaching staff, they often use this group on a permanent and continuing basis. This perpetuates the dilemma of bifurcated faculty (Gappa & Leslie, 1993; Leslie, 1989; Spangler, 1990). Bifurcation is a division of faculty consisting of tenured *haves* and the part-time *have-nots*. One sustains the other, with the low costs of the part-time faculty sustaining the continuation of a tenure system that protects the jobs of full-time faculty.

Bragg, et al. (1995) suggested another form of faculty inequity. Their study on work-based learning found that health-related programs had an average of 14 faculty equally divided between full-time and part-time status. Nonhealth programs, such as manufacturing, had half that number with an average of only three full-time and four part-time faculty. Student contact hours in work-based learning required an average of

741 hours in health-related occupations, compared with 770 contact hours in nonhealth-related occupations. Although accreditation groups and standards may affect faculty requirements, this apparent inequity suggests that work-based learning in nonhealth programs may be under-resourced in staff and budget when compared to health programs.

There has been long-term opposition to the extensive use of part-time faculty, with the premise that they are primarily used to meet fiscal constraints (Eells, 1931). Many opponents of extended use of part-time faculty believe that community colleges sacrifice quality for economic savings. Part-time faculty are often hired with little notice, making it difficult for many new instructors to prepare adequately. Opponents also feel that part-time faculty receive little or no training, support, or supervision. Consequently, some feel that the use of part-time faculty can be hazardous to programs, institutions, and individuals. They feel that staffing ongoing programs with part-time faculty should be replaced with full-time, tenure-track positions (Leslie, 1989; National Education Association, as cited in Gappa & Leslie, 1993; Rose, 1992; Thompson, 1993). Although there is a concern for too much dependence on the use of part-time faculty, administrators must accept responsibility for the apparent lack of support that part-time faculty receive in the performance of their academic duties.

The use of part-time faculty that started out to be a temporary solution has become a permanent fix. Additionally, hiring too many part-time faculty members in proportion to full-time faculty is a short-sighted management practice (Franklin, Laurence, & Denham, 1988; Gappa & Leslie, 1993). Franklin, et al. (1988) argued that over use of part-time faculty compromises program integrity and coherence by having too few full-time faculty. The Commission on the Future of Community Colleges (1988) also expressed its concern over the extended use part-time faculty when it suggested that increasing numbers of part-time faculty at many colleges are a disturbing trend. The commission urged that the unrestrained expansion of part-time faculty be avoided, because there is institutional neglect by excluding part-time faculty from the collegium. Furthermore, hiring procedures

for part-time faculty are unsystematic and often arbitrary (McGuire, 1993). McGuire passionately asserted that the practice is “. . . a cheap fix, a dangerous addiction, or exploitation of the worse kind” (p. 2).

Although part-time faculty may be outstanding in their own fields, most are not trained as teachers. Because most have not had professional education courses, part-time instructors lack knowledge concerning successful teaching techniques (Bender & Breuder, 1973; Woodberry, 1991). Additional concerns about part-time staffing are:

1. Lack of formal hiring procedures leading to a failure of affirmative action and arbitrary firings.
2. No long-term commitment to the institution.
3. Ineffective teaching resulting from inadequate evaluation.
4. Little provision for student contact outside the classroom.
5. Over-representation by administration and little representation of faculty in faculty recruitment.
6. Low faculty morale.

Furthermore, part-time instructors have less teaching experience; they are less likely to hold memberships in professional associations; they read fewer scholarly and professional journals; and they are less concerned with the broader aspects of curriculum and instruction (Cohen & Brawer, 1977; Friedlander, 1980). There must be formal hiring procedures for all instructors, as they are crucial for producing quality education (Marsh & Lamb, 1975).

2.6 Effective Use of Part-Time Faculty

No one argues against using part-time faculty in moderation as there are practical reasons for such use. When community colleges use part-time technical faculty effectively, there can be substantial benefits. For example, high-tech specialists with specialized skills are ideally suited for part-time faculty employment when occupational clusters require that expertise (Spangler, 1990). However, Hartleb and Vilter (1986) expressed their concerns about using part-time faculty effectively while raising the following, often unresolved, questions: What is the appropriate mix of full- and part-time faculty members in a program? Are there too many or too few part-time faculty members? Can there be too few? What level of full-time faculty is necessary to maintain the intellectual climate for a healthy and dynamic consideration of the department or institution? What is the long-term impact of employing substantial numbers of part-time faculty?

Despite the debate over instructional quality of part-time faculty, more than 20 years of research yields little or no difference in instructional ability of part-time faculty when compared to full-time faculty (Roueche, et al., 1995). Studies suggest that although there is an assumption that part-time faculty have a negative effect on student learning, students are unaware, or indifferent toward differences between part- and full-time faculty status (Gappa, 1984; Leslie, 1989; Lundy & Warne, 1989; Turgeon, 1983). There is a conspicuous lack of evidence that part-time faculty are ineffective teachers (McGuire, 1993). Lombardi (1975) argued that most differing judgments about effectiveness show little objective evidence. Most are subjective and often rationalized to support an opinion or practice.

Empirical research must provide objective evidence of faculty effectiveness. For example, research conducted for the National Fire Academy (Clark, 1990) found no statistically significant difference between the mean test scores of students taking a fire

science class from either full-time faculty or part-time faculty. Clark recommended the Academy continue to use part-time faculty to teach the course and conduct similar studies in other curriculum areas. Educational outcomes should then be included in future strategic decision making processes.

Cruise, Furst, & Klimes, (1980) conducted a study to determine if there was a difference in the teaching effectiveness between part- and full-time instructors. After comparing three separate evaluation instruments of student evaluation of teachers, teacher self-evaluation, and administrator evaluation of teachers, they concluded there were no statistically significant differences between the two groups on faculty effectiveness. Part-time instructors are just as effective as full-time faculty at a lower cost. However, there must be more research before generalizations can be made.

Major reviews and research on full- and part-time faculty suggest that instructional practices between the two groups differ considerably (Roueche, et al., 1995). For example, Friedlander (1980) indicated that part-time instructors had less teaching experience, had taught fewer years at their current institution, and held lower academic credentials. The part-time instructor also differed from the full-time instructor in that there was less choice in the selection of course materials. Part-time instructors assigned less homework, used less instructional media, and placed less emphasis on written assignments in determining student grades.

Although the debate continues surrounding the advantages and disadvantages of using part-time faculty, Vaughan (1986) suggested that community colleges will attempt to provide more service with fewer resources by using part-time faculty. Munsey (1986) summarized the importance of part-time faculty to the institution: The relationship between community college and community creates a situation that makes the employment of part-time faculty highly advantageous. The community college can benefit economically with part-time instructors, a factor of increasing importance in this era of changing enrollments and of wholesale budget cutting. Colleges offer a greater variety of courses at a greater

variety of hours and locations than it could provide by using full-time faculty alone. Specialists from industry can teach with hands-on expertise in their fields. Part-time faculty can also provide a pool of experienced instructors from which full-time persons can be hired as needed. Finally, part-time instructors can serve as a source of public relations for the college, since most also hold full-time positions in the community. When treated with respect and consideration by the administrators and full-time faculty, they can serve as sources of encouragement both to prospective students and to other potential part-time teachers.

According to McGuire (1993), not only do part-time faculty play an important role for community colleges, many are good teachers. They receive the same ratings and achieve the same student outcomes as full-time instructors. They bring relevance to the curriculum and allow colleges to teach subjects that would otherwise be excluded from the curriculum. They can also provide a strong link to the to business and industry. Because part-time faculty have experience as teachers, they are a logical resource for recruiting full-time faculty as the need arises. When used in these important roles, McGuire calls such part-time faculty as *key institutional assets*.

Along with the need for flexibility in dealing with non-traditional schedules and other mechanical demands, applicants for part-time occupational instructor positions should possess the subtle, but important dimension of emotional flexibility. Learning residuals, such as attitudes, values, and social competence also change in well-conceived, occupationally-specific programs. To prepare students to meet the challenges of the world of work, faculty members must have expertise in their respective fields (Gleazer, 1968; Prosser & Allen, 1925). A major difficulty in faculty recruitment is trying to find applicants who have sufficient flexibility to accept new roles easily. They must also have the ability to adapt to an educational environment and be able to express positive learning residuals, such as attitudes, values, and social competence (Cohen, 1969). Such residuals can be transferred to industry by graduating students.

2.7 Summary of Semiconductor Technology

With over five billion microprocessors in the world, the semiconductor industry influences practically every electronic device produced today (Reis, 1993). The long-term outlook is very positive for the semiconductor industry over the next decade. In addition to the use of semiconductors in telecommunications and computer networking, other industries are expanding the need for semiconductors. Automobile electronics, high definition television (HDTV), and *smart* credit cards are but a few applications that will become bonanza markets for chipmakers (Standard & Poor's, 1995).

The development of emerging technologies has coincided with a period of profound instability and job loss in many older industries, such as textiles, steel, and timber. The burgeoning demand for semiconductors has stimulated a need for technical positions. Careers in manufacturing technology, engineering and scientific disciplines are among the growth careers beyond the year 2000 (Basta, 1989; Field, 1992; Oregon Career Information System, 1995).

Because of frequent technological advances, the semiconductor industry represents a break with previously dominant patterns of industrialization in advanced economies. Angel (1994) suggested that semiconductors represent of an ensemble of science-intensive and technology-intensive industries. The qualities of scientific and engineering resources increasingly determine the competitive advantage in these industries, not by wages or other costs.

To better understand the semiconductor industry, it is helpful to have a working knowledge of its technology, addressing both semiconductor devices themselves and the processes by which they are produced. Semiconductor substances, usually crystalline in form, are neither good conductors nor good insulators. However, in the presence of carefully specified and controlled *impurities* or dopants of other materials, they can reliably produce precisely designated electrical characteristics. Among the most important

contribution is their ability to control electrical current at very low voltages. Ultimately, lessened power requirements permit operation of very complex miniaturized equipment with minimal power requirements (Jelinek & Schoonhoven, 1992).

While there are many semiconductor materials, silicon is the most important. It is widely available and relatively inexpensive. Since silicon devices operate reliably at higher temperatures they have essential stability. Another important characteristic of silicon is its property of forming predictable electrically insulating oxide (SiO_2 , a form of glass) when exposed to oxygen. The underlying silicon is then protected from external contamination when covered with the silicon dioxide layer. These properties of silicon and silicon dioxide provide the basis of the most widely used production processes (Jelinek & Schoonhoven, 1992).

Semiconductor manufacturing begins with 99.9% pure silicon in the form of long, slender bars. The bars are heated and reconstituted as a single, continuous crystal. The single-crystal silicon rod is ground to size, typically 10-20cm in diameter, and then sawed into thin slices or wafers, usually 0.25 to 0.8mm thick. Wafers are etched and lapped on both sides to remove damage to surface layers caused by sawing. One side is then polished to a mirror finish. Wafers are then cleaned to remove grease, dust from mechanical operation, and any other contaminants (Jelinek & Schoonhoven, 1992).

The silicon wafer products are then used as a surface upon which integrated circuits are placed. These circuits are carefully specified regions of positive, negative, or neutral electrical characteristics. They are precisely arranged on silicon wafer surfaces which then constitute electrical devices (Jelinek & Schoonhoven, 1992). Appendix B illustrates the production process *From Silicon to Chip*.

Most U.S. semiconductor firms use outside silicon foundries, such as SEH America (SEH) in Vancouver, Washington (Shin-Etsu SEH America, 1995). Rising costs of wafer fabrication facilities make it necessary for an outside subcontractor, such as SEH, to be used as an exclusive source of wafer fabrication. Partnership agreements

between U.S. design houses and foreign wafer fabrication foundries represent many strategic alliances established during the 1980s (Angel, 1994).

2.8 Connections Between the Semiconductor Industry and Education

Emerging technologies, such as the semiconductor industry, are important to postsecondary education because knowledge and labor skills are radically different from older industries. The semiconductor industry draws upon new types of knowledge and labor skills and provides a new basis for durable regional economic growth and development. This industry offers a new model for industrial and regional development by increasing focus on continuous innovation where the competitive advantage focuses on the development and deployment of new technologies ahead of competitors (Angel, 1994). Additionally, these manufacturers need not be restricted geographically, as are the declining steel and forest industries.

Many community colleges must therefore examine their goals and objectives to satisfy the needs of the semiconductor industry. Although occupational education encompasses a broad spectrum of representation in the workforce, the semiconductor industry offers unique challenges and benefits as it meets the demands of our economy. It is important, therefore, to investigate this specific area of industry and its relationship to community college work-related programs.

Local community colleges report they offer courses that prepare operators and technicians for the semiconductor industry. Local program offerings vary as community colleges try to meet local needs. For example, Portland Community College (Portland, Oregon) offers degree and/or certification programs in computer integrated manufacturing, computer software, engineering technology, machine manufacturing technology, mechanical engineering technology, and manufacturing engineering technology. Lane

Community College (Eugene, Oregon) offers a two-year Associate of Applied Science degree program for Electronic Engineering Technician. Satisfactory completion of this program qualifies the student for entry-level employment as an electronic engineering technician, electronic production technician, electronic instrument technician, or industrial electronic technician. Clackamas Community College (Oregon City, Oregon) includes technical programs, such as industrial technology, manufacturing technology, precision metal fabrication technology, quality control technician, and screw machine technology. Linn-Benton Community College (Albany, Oregon) offers programs in electronic engineering, electronic engineering technology, and process development.

Industry and community colleges can analyze course relevancy by comparing job descriptions for technical specialists such as those shown in Appendix B (Semiconductor Workforce Consortium, 1995). Another benchmark for determining the workplace relevancy of technical courses is to investigate how well recent graduates from community college technical programs perform on the job as newly employed operators and technicians.

A major challenge for educators is responding effectively to the needs of the semiconductor industry. Postsecondary institutions must train technical specialists to an acceptable level of competence to meet the needs of this industry. Earlier studies by Angel (1989; 1990) found that the proximity of semiconductor producers in Silicon Valley (Santa Clara County, California) allowed many technical specialists interfirm worker mobility during the 70s and 80s. Today, however, many semiconductor companies are locating major facilities in the Pacific Northwest; so much so that the industry now calls this region the *Silicon Forest*. The expansion of the semiconductor industry in Oregon and southwest Washington has been dramatic. This industry is booming and urgently needs new plant capacity to keep up with the increasing demand (Conerly, 1995). Worldwide, this market is projected to grow by more than 26% in 1996 to \$185 billion. However, due to a drop in semiconductor sales since its peak in

September 1995, Kaufman (1996) predicts growth in the semiconductor industry more conservatively, ranging from 20% to 25% for 1996.

Today, the largest concentrations of chip production in the country are in California and Texas, with Oregon and Washington becoming new preferable locations. Labor and land costs continue to shift production outside of California. Attractiveness and quality of life in the northwest are also major factors as semiconductor manufacturers consider expansion. There is no need to locate in a place considered undesirable. Conerly (1995) further suggests that it is easier to build a new plant in an area where similar plants already exist. Specialized support services may already be available locally and the new company may be able to hire experienced people away from existing firms. Furthermore, workers will also share knowledge and practices, making all companies in the area more competitive than isolated businesses.

The latest addition to the industry is a proposed \$4 billion expansion project by LSI Logic in Gresham, Oregon. If approved, this expansion will be the largest of its kind in the history of the semiconductor industry. Intel set the previous expansion record by building a \$2 billion chip manufacturing complex in Oregon. Fujitsu Microelectronics recently received approval for a \$1 billion expansion project for its computer chip plant in Oregon (McCall, 1995).

Two South Korean companies, Hyundai and Samsung Electronics are also establishing major facilities in Oregon. Hyundai is currently building a \$1.3 billion plant and Samsung has proposed a \$1.5 billion factory (McCall, 1995). In the Portland area alone, the value of pending and potential semiconductor chip and wafer plants exceeds \$10 billion, while the real estate value in downtown Portland is about \$2 billion (Francis, 1995). Because of the explosive growth of the Silicon Forest, economist John Mitchell (as cited in McCall, 1995, p. A5) suggested that it has become the “. . . poster child of industrial transformation”. The amount of high-tech investment in the pacific northwest is shown in Table 2.1 (McGregor, Millette & Associates, 1995).

Table 2.1 High-Tech Investment in the Pacific Northwest as of August 4, 1995

Company	City/State	Products	Cost \$ million	New Jobs	Status
LSI Logic (phase 1)	Gresham, OR	Custom Computer Chips	600	400	Confirmed
LSI Logic (later phases)	Gresham, OR	Custom Computer Chips	3,400	1,600	Confirmed
Intel Corp.	Hillsboro, OR	Microprocessors	2,200	1,400	Confirmed
Fujitsu Microelectronics	Gresham, OR	Computer Chips	1,030	445	Confirmed
Integrated Device Tech.	Hillsboro, OR	Computer Chips	800	975	Confirmed
SEH America	Vancouver, WA	Silicon Wafers	710	600	Confirmed
Intel Corp.	Aloha, OR	Microprocessors	705	355	Confirmed
Komatsu Electronics	Hillsboro, OR	Silicon Wafers	450	300	Confirmed
Siltec Corp.	Salem, OR	Silicon Wafers	350	400	Confirmed
Wacker Siltronic Corp.	Portland, OR	Silicon Wafers	240	300	Confirmed
Linear Technology	Camas, WA	Analog Devices	25	330	Confirmed
Epson Portland, Inc.	Hillsboro, OR	Printers	15	500	Confirmed
Sharp Laboratories	Camas, WA	Research & Development	8	100	Confirmed
Tokyo Electronics			15	250	Confirmed
		Total Confirmed:	10,548	7,955	
Hyundai Electronics	Eugene, OR	Memory Chips	1,300	1,000	Pending
Toshiba Electronics	Hillsboro, OR	Memory Chips	1,200	300	Pending
NEC Corp.	Hillsboro, OR	Memory Chips	1,000	300	Possible
		Total Pending/Possible:	3,500	1,600	
		Grand Total:	14,048	9,555	

Source: McGregor, Millette & Associates (1995)

These and other companies, such as Hewlett Packard and Siltec Silicon, have created an urgent need for technicians and engineers to meet their production demands. Although interfirm worker mobility exists within the semiconductor industry in Oregon, the demand for qualified technicians and engineers exceeds the supply. Within the next five years, nearly 7,500 new jobs will be created within this industry. This growth will increase if other industry-related companies decide to locate in Oregon (Allen, 1995; Gonzalez, 1995; McCall, 1995). For example, the building of a \$1.3 billion semiconductor plant by Hyundai in Eugene, Oregon further compounds the worker

shortage. Hyundai anticipates difficulty in staffing approximately 900 positions, many of which will be for technicians and engineers. Between Salem and Portland, Oregon, other large semiconductor plants are hiring hundreds of new employees. The semiconductor industry, Oregon's hottest manufacturing sector, is predicting a labor shortage in the coming years. When Intel's Hillsboro plant opens, it will further stress the limited labor pool Hyundai hopes to tap when it completes its factory in Eugene (Kidd, 1995).

Many industry officials and Oregon economists (Warner, as cited in Barnett, 1995a) predict that the multibillion dollar semiconductor expansion in Oregon will continue through the end of the decade. Mitchell (as cited in Cain, 1996, Oct. 16) reports that Oregon high-tech growth continues to boom with 3,200 new jobs added in 1996. By 2001 Warner (as cited in Thomas, 1996) predicts the semiconductor industry and other electronics companies will add 11,500 new jobs to the state, employing 73,000 compared with the timber industry employing 55,000. The Willamette Valley (Oregon) alone currently produces at least 8,300 hardware related jobs, with an annual average wage of \$39,700. This annual wage is 27% higher than the average timber related job.

As computer chips move into formerly low-tech consumer products, chip production becomes practically limitless. Such new marketing opportunities will greatly stabilize the cyclical increases and declines in business and provide continued growth well into the 21st century (Barnett, 1995b). Computer chip executives refer to this expansive growth as the *silicon age*. Consequently, the demand for an increased pool of skilled labor increases. Table 2.2 shows the number of graduates of semiconductor-related programs of four representative Oregon community colleges.

Carter (1995) expressed concern that the explosive growth of the chip business in the Pacific Northwest surprised everyone, including community colleges that train workers for high-tech careers. These institutions cannot produce trained workers fast enough for the industry, which has to go out of state, particularly for high-skilled workers. The semiconductor industry anticipates hiring at least 8,000 new technical specialists. This

Table 2.2 Semiconductor-Related Education and Training at Oregon Community Colleges

Program	Target Occupations	Length of Program	Total No. of Graduates Possible (per yr.)	Output of Graduates (per yr.)
CHEMEKETA CC (Salem, Oregon)				
Electronic Assembly and Mfg.	Operator	6 weeks	15	as needed
Electronic Engineering Technology	General Electronics	2 years	30	20
Industrial Electronics Tech	Equipment Repair	2 years	24	6
LINN-BENTON CC (Albany, Oregon)				
General Electronics Mfg. Skills	Operator	7 weeks	90	15 every 7 weeks
Electronic Engineering Technology	Equipment Repair Technician	2 years	20	45
Process Development Assistant	Operator	1 year	10	10 (varies)
MT. HOOD CC (Gresham, Oregon)				
Microelectronics Technology	Semiconductor Mfg. Equipment Technician	2 years	Dependent on enrollment (on-site training)	0
Electronics Systems	General Equipment	2 years	48-50	20
PORTLAND CC (Portland, Oregon)				
Electronic Assembly & Mfg.	Technician Operator	2 weeks	15	as needed
Microelectronics Technology	Semiconductor Mfg. Technician	2 years	100	4 to date with 80 declared majors enrolled part-time
Electronic Engineering Technology	General Electronics	2 years	50	15
Semiconductor Operator	Operator	2 weeks	20	as needed

Source: Semiconductor Workforce Consortium, 1995

including floor operators, technicians and engineers for companies that could build new plants or expand in the Portland area and Willamette Valley. The number of students either getting initial training or upgraded education is far below the numbers needed and there is no statewide plan that might coordinate education and technical training in the field.

The lack of a statewide plan to coordinate education and technical training in the field is not the only immediate problem in producing skilled labor. The National Research Council (as cited in Hernandez, 1995) found that Oregon's public colleges are ranked in the bottom half of the nation in key technical areas. These areas include electrical engineering and computer science. According to Hernandez (1995) the attempts of Oregon higher education to respond adequately to the needs of the high-tech industry are hampered by the system's lack of organization. Much of this lack of organization and direction is from higher education. While many states, such as Texas and California have increased their budget for higher education by as much as 10%, Oregon cut its higher education budget by more than 10%, from \$485 million in 1992 to \$434 in 1995.

Some semiconductor companies, such as Samsung, Toshiba, and Sumitomo Sitix, sensed the state's lack of academic commitment and have planned research and production facilities outside of Oregon. For example, Samsung underscores Oregon's higher education problems by suggesting that higher education in Oregon lacks the environment for technology education and research (Hernandez, 1995).

Recognizing the need for improvement in technical education, regional workforce development councils are discussing ways to build technical training centers and improve the connections between school and work (Crockett, 1995). These councils are responding to the need for skilled training, because without advanced technical training many low level workers will probably be replaced by automation within the next five years. Local workers not replaced by automation who do not increase their professional skills will remain at the lower end of the pay scale. Because the lack of local available

training resources, Crockett suggests that many higher-paying jobs will go to people from out of state, as shown in Table 2.3.

Table 2.3 New Technical Specialist Jobs in the Semiconductor Industry

Capacity	Oregonians	Out of State
Engineers	10%	90%
Technicians	50%	50%
Operators	90%	10%

Source: Semiconductor Workforce Consortium and Portland Development Commission, 1995

The labor shortages for additional technicians and engineers in the semiconductor industry are not unique to Oregon. For example, in 1996, there is an anticipated need for an additional 100,000 clean room technicians throughout the country (McIlvaine Co. as cited in Gonzalez, 1995). Although not explicitly stated in these findings, it follows that there will be a need for postsecondary training to meet the demands of industry as labor shortages arise.

A new trend in industry may be linked to the use of part-time faculty because part-time work in industry is also increasing (Gianini & Sarantos, 1995; Jackofsky & Peters, 1987). For example, Roueche, et al. (1995) forecast by the year 2000, IBM will classify more than 80% of its workforce as part-time. Dow Chemical is now only hiring individuals with specialized skills, to accomplish specific and specialized tasks for specified periods. Such specialized industrial skills include having a background in chemistry, mathematics, and engineering. Part-time employees are proving to be so useful that some institutions are converting some of their full-time positions into many

part-time positions (Tucker, as cited in Roueche, et al. 1995). This part-time trend in industry may allow technical specialists to devote some of their time as part-time instructors.

Technical specialists who have experience with current and emerging technologies can be a valuable resource to community colleges. Many community colleges hire part-time faculty not because of extensive academic preparation, but because of real-world experience. This is an important feature in highly technical fields (Roueche, et al., 1995). As a resource continuum, the semiconductor industry can satisfy its current and future needs for operators and technicians by providing technical specialists to the community college as part-time instructors. Although this will help increase the pool of qualified part-time instructors, it does not guarantee success in teaching. Other factors, such as interest, motivation and self-efficacy, influence teacher effectiveness.

2.9 Basis for the Theoretical Framework

Technical specialists view their skills with their application in the workplace and not with teaching. Is it possible for these specialists to transfer their occupational skills to teaching these skills effectively to others? Self-efficacy, or the belief that technical specialists can successfully teach, may be an important factor in determining if they choose to teach-part time at community colleges.

2.10 Bandura's Theory of Self-Efficacy

Bandura (1977, 1982) uses the term *self-efficacy* to describe the beliefs that people have in their ability to perform certain behaviors or tasks. Bandura postulates that self-efficacy is a major mediator of behavior and behavior change. As such, self-efficacy

expectations are not reducible to one's objective skills, such as testing equipment or implementing quality control procedures. These expectations concern one's beliefs about one's capabilities that influence the performance of a specific task, or behavior. Low self-efficacy expectations lead to the avoidance of that behavior. Increases in self-efficacy expectations should increase the frequency of approach versus avoidance behavior. Efficacy expectation, therefore, is the belief that one can execute the behavior required to produce successful outcomes (Bandura, 1982).

Efficacy expectations also influence the amount of expended effort and affect the length of sustained behavior in the face of obstacles and adverse experiences. People avoid activities that they believe exceed their capabilities, but they undertake and perform activities that they perceive themselves capable of managing (Bandura, 1982). Self-efficacy expectations, therefore, are not reducible to one's objective skills, but to one's beliefs about perceived capabilities. Mager (1992) suggested that when people judge themselves unable to perform a given task such as teaching, they may not even try. They may choose not to attempt a challenge in which they might excel. Luzzo (1993a, 1993b) found a significant, positive relationship between self-efficacy expectations in the career decision-making process with attitude and skills. These should be specifically targeted at increasing one's ability to engage in effective career decision making.

Peterson (1993) found sufficient evidence to warrant the inclusion of the variable self-efficacy, as an important factor in the career decision-making process. Peterson concluded that the likelihood of a significant relationship between self-efficacy and the career-decision making process was enhanced by persistence in the face of obstacles. However, persistence can vary according to (a) performance accomplishments, (b) vicarious learning, or modeling, (c) verbal persuasion, or encouragement from other people to engage in a specific behavior, and (d) degree of emotional arousal, or anxiety, with reference to a domain of behavior, such that the higher the anxiety, the less self-efficacious the individual will feel.

2.11 Effects of Self-Efficacy on Behavior

Lent, Brown, and Hackett (1994) suggested that self-efficacy is not a passive, or static trait. It is a dynamic set of self-beliefs that are specific to particular performance domains. These self-beliefs interact with other factors, such as context, the nature of the behavior, and other person's involvement. Mager (1992) offered additional insight into self-efficacy by suggesting self-efficacy has five main effects on behavior:

1. Choice of Behavior. Choices are often affected by how efficacious an individual feels toward various options. For example, if an individual's self appraisal is that he or she will be a poor teacher, that person may refuse an offer to teach.
2. Motivation. People with high self-efficacy will exert more effort than those with low self-efficacy. That is, those who believe in their ability to succeed in teaching will be more likely to strive harder to attain that goal.
3. Perseverance. People with high self-efficacy persevere even when confronted with obstacles and negative outcomes. Efficacious individuals perceive a failure as only a temporary setback, rather than a final result.
4. Facilitative Thought Patterns. Thought patterns are influenced by self-efficacy. Those with high self-efficacy envision success scenarios; those with low self-efficacy envision failure scenarios.
5. Vulnerability to Stress and Depression. Those with low self-efficacy are more likely to experience stress and depression, because they expect their future performance as a teacher will lead to failure. Conversely, those with high self-efficacy approach the teaching challenge with the perceived assurance that they can succeed.

2.12 Application of Bandura's Self-Efficacy Theory to Career Behavior

The application of Bandura's (1977) theory of self-efficacy to the understanding of career choice behavior has received much attention in the career development literature (Bergeron & Romano, 1994; Betz & Hackett, 1986; Taylor & Popma, 1990; Wheeler, 1983). Since behavioral expectations influence choice, persistence, and performance in career-related domains, Hackett and Betz (1981) were the first to apply Bandura's (1977) self-efficacy theory to career behavior. They applied Bandura's four elements of efficacy expectations through potential modification in career development. These elements were: (a) performance accomplishments, (b) vicarious learning or modeling, (c) verbal persuasion, or encouragement from other people to engage in a specific behavior, and (d) degree of emotional arousal, or anxiety, with reference to a behavior domain.

After applying Bandura's (1977) four sources of experiential information to career self-efficacy, Hackett and Betz (1981) found background experiences in a given behavioral area affect specific performance accomplishments: (a) vicarious learning, (b) verbal persuasion and encouragement, and (c) lack of anxiety associations. When these performance accomplishments were met, they postulated that the individual developed high self-efficacy expectations with respect to that situation, or domain. These expectations are considered the primary cognitive determinants for an individual to attempt a given behavior in a career extension. For example, technical specialists experience self-efficacy expectations as they consider teaching part-time at a community college. In doing so, they expand their expertise from industry to a new occupational area of teaching. Such career enhancement can result in the successful performance of a given behavior, as in the case of deciding to teach part-time. Successful performance is perhaps the most powerful source of strong self-efficacy expectations (Hackett & Betz, 1981). A problem arises, however, when traditional recruitment practices fall short in understanding and exploring self-efficacy as potential teaching applicants decide to

expand their careers. According to Saks, Wiesner, and Summers (1994) there is little discussion or testing on self-efficacy as a theory of job choice. However, career self-efficacy receives considerable attention in the career literature as an important variable in career decision making. Findings from Multon, Brown, and Lent (1991) suggested self-efficacy beliefs generally relate to behaviors in ways that support Bandura's (1977) theory and its extension to occupational choice behavior. Bores-Rangel, Church, Szendre, and Reeves (1990) noted that given the theoretical framework of self-efficacy it would be profitable to investigate the relationships among self-efficacy and interest at the level of individual occupations.

Taylor and Betz (1983) applied the theory of self-efficacy to the understanding and treatment of career indecision. In the career decision-making domain, they hypothesized low self-efficacy expectations lead to avoidance of tasks and behaviors requisite for making quality career decisions. High self-efficacy expectations are likely to increase the frequency of approach behavior versus avoidance behavior. Self-efficacy expectations affected the tasks or behaviors required in the career decision process. The resulting instrument is called the Career Decision-Making Self-Efficacy Scale. It provides a useful measure for the assessment of people who have difficulty making career decisions. Research findings suggest a moderately strong relationship between career decision-making and self-efficacy. This includes the relation of career self-efficacy to other career-related variables, such as ability and vocational interest (Hackett, Betz, O'Halloran, & Romac, 1990; Ross, 1994). A meta-analysis of career self-efficacy (Multon, Brown, & Lent, 1991) supports the premise that stronger perceptions of self-efficacy in career related behaviors significantly relate to outcome behaviors. Betz (1994) suggested that the career self-efficacy theory is based on subjective perceptions of characteristics. The important variable influencing individuals' perceived range of career options was not their measured abilities, but their beliefs concerning their ability to achieve success in various behavioral domains.

Research demonstrates that career self-efficacy is predictive of career decision making (Taylor & Betz, 1983) and willingness to engage in nontraditional career activities (Nevill & Schlecker, 1988). Most of these investigations examined dimensions of content of career choice behaviors, such as the choice of a major area of study or occupation. Betz and Hackett (1986, 1987) suggested that career choice dimensions should be more closely examined by using the perspective of self-efficacy. Multon, Brown, and Lent (1991) were confident that self-efficacy beliefs relate to important performance and persistence variables in academic contexts. They suggested that more research, however, was needed in understanding indecision to the workplace. In analyzing the treatment of indecision, Mager (1992) suggested five ways to strengthen self-efficacy:

1. Performance Mastery. The most powerful way to increase an individual's self-efficacy as a teacher is to teach that person how to become an effective teacher. However, development of mastery is not enough. In order for mastery to have maximum effect on self-efficacy, feedback needs to be constructive and supportive. As people learn they are the cause of their performance, the feedback will have a positive effect on their perception of competence.
2. Task-Diagnostic Feedback. One can interpret negative feedback information either through self-diagnostic or task-diagnostic modes. The self-diagnostic mode focuses negative feedback on the individual, rather than on the task to be performed. This places the learner in a defensive position. The task-diagnostic mode focuses on the task to be performed. Interpretation of positive or negative feedback can be used to improve task performance where the person is learning-oriented and not defensive.
3. Modeling. Self-efficacy can be improved when potential part-time teachers watch others like themselves accept teaching responsibilities. The more similar the model is to the potential teacher, the greater the positive modeling influence.

4. Social Persuasion. Comments and actions of others influence self-efficacy. Unkind comments can have powerful effects on self-efficacy, but social persuasion can also be used to strengthen self-efficacy.
5. Inference From Physiological Information. People may infer ability, or inability, to be a part-time instructor, from physiological cues, such as aches, pains, perceived effort, and emotional arousal. If they have to work hard to achieve success in teaching, they may interpret that fact as a lack of personal ability rather than being part of the normal cycle of classroom success and struggle.

As technical specialists consider expanding their careers to become part-time instructors, self-efficacy is an example of an individual characteristic that may have direct implications for decision-making to teach part-time. Although low self-efficacy may be a barrier to teaching other barriers need to be examined.

2.13 Interest in Teaching

Tangential to career indecision is how potential part-time instructors perceive occupational education. Many educators and students perceive occupational education as lacking prestige. Considering the importance of occupational education, applicants for part-time positions, educators, and students must examine the perception of relative prestige. The problem of academic perception begins with our society's enthusiasm for white-collar occupations where society generally emphasizes the importance of professional and managerial categories. Consequently, blue-collar occupational categories receive lower status. Gleazer (1968) quoted an unnamed statesman: "Our young people are afflicted with academic disease. [They] want to be political scientists and philosophers and statesmen, whether or not they have the necessary aptitudes and abilities.

Furthermore, this country needs surveyors, and secretaries, and nurses, and mechanics, and we need many more of these than we do of the others” (p. 71). Some of these perceptions are rooted in broad, cultural attitudes and others stem from the attitudes of the educational profession (Gleazer, 1968).

As technical specialists consider teaching part-time at community colleges, factors such as interest, academic perceptions and ability to teach may affect their decision. Much of the interest and success of teaching depends upon the expectation or belief that a part-time instructor applicant can be successful in this field. Self-efficacy and interest may be important factors in understanding the barriers to teaching by technical specialists.

Research using the Career Decision Scale (Osipow, Carney, Winer, Yanico, & Koschier, as cited in Bergeron & Romano, 1994) and the Vocational Decision-Making Difficulty Scale (Holland & Holland, 1977) suggested several common factors of indecision that affect career direction: (a) lack of confidence in decision-making skills, (b) lack of a clear sense of personal identity, (c) external barriers to preferred choices, and (d) lack of immediacy of the need to make a decision.

The lack of self efficacy appears to compound the avoidance of a vocational choice (Holland & Holland, 1977; Osipow, Carney, & Barak, 1976) and the variable of efficacy would be useful when applied to direct implications for intervention (Osipow, et al., 1976; Slaney, Palko-Nonemaker & Alexander, 1981). Awareness of the components of interest and indecision is helpful to better understand self-efficacy in extending one's normal career. Awareness of indecision factors appears appropriate in helping applicants realize their possible potential as they consider extending their career by teaching acquired skills part-time to others.

As a parallel to the motivational construct within the framework of self-efficacy (Mager, 1992), Daniel and Ferrell (as cited in Ferrell & Daniel, 1993) and Vaughan (1995) noted that the majority of studies of teacher career interest were descriptive in nature. These studies generally used survey or interview procedures in which

respondents were asked to indicate why they chose to teach. The three most important reasons for wanting to teach are: (a) fondness and desire to work with others, (b) favorable working conditions (flexible hours, desirable personal relations), and (c) interest in a particular subject.

Studies by Leslie, Kellams, and Gunne (1982), Lortie (1975) and Joseph and Green (1986) attempted to build models to explain why people are interested in teaching. These researchers provide eight thematic categories of motivation that enable us to understand why some individuals want to teach:

1. Interpersonal Theme: a desire to work with people.
2. Service Theme: an altruistic desire to serve others.
3. Continuation Theme: a fondness for education, with a desire to maintain a relationship.
4. Material Benefits Theme: compensation.
5. Time Compatibility Theme: flexibility of scheduling.
6. Stimulation Theme: a view of teaching as a chance to become involved in creative and rewarding work.
7. Influence of Others Theme: motivation to teach based on desires of a relative, teacher, co-worker or other influential person.
8. Psychological Theme: a desire for psychological security, such as becoming an authority figure or to receive love and respect from others.

In 1993, Ferrell and Daniel conducted research to substantiate the construct validity of the motivational themes found by Lortie (1975) and Joseph and Green (1986). Although incomplete, the analyses of Daniel and Ferrell (1991) offers at least initial support for the construct validity of these themes. This may provide a useful tool when conducting further research on teacher interest.

2.14 Awareness of Teaching Opportunities

Regardless of the interest and motivation for teaching, if technical specialists are not aware of vacant part-time teaching positions, it is unlikely that the pool of part-time faculty will realize its potential. Ineffective recruitment may prevent them from becoming part-time instructors. To increase the pool of qualified occupational specialists who are willing to teach part-time, administrators must consider using proactive recruitment practices. In addition to meeting institutional recruitment goals, these practices should also focus on applicant-centered needs. Applicants should understand the nature and role of the part-time occupational instructor. This understanding will better enable them to make an informed decision as they view their ability to assume that role (Hackett & Betz, 1981). However, traditional recruitment practices seldom view the staffing problem from the applicant's point of view.

Institutions draw from several sources of part-time faculty recruitment. These sources are teachers from secondary schools, faculty from local four-year colleges, new graduates in various disciplines, and specialists from trades, industry, business, and government administration (London, 1989). Maurer, Howe, and Lee (1992) suggested that regardless of the source the recruitment process must maximize human capital returns for each position offered. Recruiters accomplish this goal by filling jobs with the greatest possible number of best qualified applicants.

Most community colleges rely on personal contacts, secondary school teachers, unsolicited applications, or word-of-mouth recommendations from incumbent faculty members to produce a surplus of available candidates from which to choose. Bender and Breuder (1973) indicated that it is conceivable that many community colleges have not selected the most qualified part-time faculty, because of failure to institute formalized identification and selection procedures.

Thompson (1984) suggested that institutions develop a reservoir of part-time faculty members on whom they can call when necessary. These institutions usually have completed job applications, resumes, information about applicant expertise, and perhaps copies of transcripts for available instructor applicants. The institution can then shape its destiny and draw from the pool for a faculty member to teach at any given time of the day or during a particular day of the week. Thompson recommends developing an instructional pool as opposed to building a schedule around the availability of a single faculty member. Thus, the interest and needs of students are the basis for scheduling.

Although previous research does not suggest specific recruitment sources for part-time faculty in occupational education, recruitment sources for full-time occupational instructors may come from several areas. They can come from any skilled or semiskilled trade, craft, or occupation that directly functions in the designing, production, processing, assembling, maintaining, servicing, or repair of any product or commodity. Other sources of recruitment may come from technical areas, such as engineers and experienced technicians (Reed, 1967). Rice (1982) reported occupational specialists, like most trade and technology instructors, are typically hired as instructors based upon demonstrated competence in a particular occupation. Educators and administrators recognize that you cannot teach what you do not know. Skillful experience in occupations remains the undisputed and the prime qualification for trade and technical teaching, at all levels of instruction and in all types of institutions.

Regardless of the marketing strategy, there is a need for clear and unmistakable communication between educational institutions and industry. Parsons (1980) presented an eight-step strategy for recruiting and retaining effective part-time faculty in community colleges, but cautioned these steps are not guarantees of success; rather, they are offered as a unified model for the recruitment and retention of effective part-time faculty:

1. Passive role to active role. Move from a passive role to an active role in recruiting the best part-time faculty available. Too many colleges accept applicants without making a

systematic effort for recruitment. Often, last-minute recruitment occurs when emergency staffing conditions arise. The process of recruiting qualified, competent part-time faculty must be organized. Local businesses, industries, and school systems should be contacted. Advisory committees should be encouraged to recommend people. Once identified, qualified applicants must be oriented to the teaching requirements of the college. Workshops, mentoring programs, and teaching clinics have proven effective. The result of successful recruitment and orientation develops a resource of dependable part-time instructors who are attuned to the mission of the college.

2. Develop an equitable contract. Develop a contract that articulates the requirements of the college while safeguarding part-time teacher rights. Because of increased litigation in our society, it is important to agree upon employment conditions based on sound legal principles. College requirements must be clearly defined and instructor rights guaranteed.

3. Design an equitable system of parity. Current compensation schedules for part-time faculty do not reflect the important role that they play in achieving the mission of the institution. Although it may be difficult to increase remuneration in a time of shrinking resources the result of doing so will increase morale between part-time teachers and offer greater identification with institutional goals.

4. Follow affirmative action plans. A systematic needs analysis and targeted recruitment of underrepresented minorities can materially improve compliance mandates with part-time faculty. Further, increased heterogeneity among the part-time faculty should broaden the role model potential and increase minority and female student enrollment in technical education.

5. Develop support services and a communications network. Tailor these services to meet the needs of part-time faculty. Office space, audio-visual services, clerical assistance, identification cards, mail boxes, and instructional supplies are necessary if part-time instructors are to achieve their potential as effective educators. Communication

networks, including mentoring, workshops, and involvement in divisional activities, link part-time faculty with the institutional culture.

6. Design evaluation procedures. Make evaluations that assess the impact on the teaching-learning process. This design should review individual part-time instructors, with comparisons drawn as a group with full-time instructors in their field. A mix of institutionally and commercially developed instruments have proven successful.
7. Link part-time faculty with the community. Increase the college impact on new clientele in the service area through part-time faculty. These instructors move in professional circles outside their responsibility with the college. If they are informed of college goals and committed to them, they can serve as valuable links with the community. Part-time faculty can pass information to target groups to which they have access; they can recruit among potential students and faculty.
8. Develop cooperative interaction. Cooperative interaction between college and external organizations will help foster part-time faculty effectiveness. Colleges must take the leadership in identifying areas of common interest and selling these boards and agencies on cooperative development. This will broaden resources and increase teaching effectiveness.

After technical specialists are aware of teaching positions and accept a part-time position, some instructors do not remain in this capacity. Langford (1981) conducted a study at Midland College in Texas to determine possible solutions of faculty retention. Findings indicated Midland lost several of its most qualified occupational instructors to business and industry when they were offered much higher salaries. College officials then met with over 200 local business owners and managers to outline the college's staffing dilemma. The gap between faculty salaries and community pay scales was widening so quickly that even the most dedicated faculty members were finding it difficult to resist the financial incentives offered by industry. The college staff discussed the

dilemma with business leaders. If instructors continued to teach instead of working for industry, they could turn out many more qualified employees to fill vacancies in the local work force.

As education and industry sought equitable solutions to these problems, they concluded that businesses could supplement salary differentials for highly skilled instructors to make pay schedules more competitive for community colleges. Since business and industry benefit most directly from the graduates of the vocational and technical programs, Langford (1981) concluded industry should underwrite the cost of salary supplements for the highly skilled instructors. However, one must consider the consequences of differential academic salaries. For instance, it is difficult to justify the lack of parity to an academic instructor with a Ph.D. and 15 years of teaching experience, while a certified machine shop instructor is commanding a larger salary with less experience and holds an associate degree.

There is a perception by industry, however, that educators must take the lead in developing working relationships with business partners. For example, many executives of large corporations want to be part of education initiatives, but educators lack the skill or incentive necessary to affect successful interaction (Rigden, 1994). Rigden applied the following steps for cooperation between schools and businesses.

1. Business people are results oriented. Show them how they will be actively involved and how their contribution will benefit students.
2. Business people like to work from an agenda. Begin and end a meeting on time. Clarify your objectives and your concerns.
3. Be brief and to the point. Avoid educational jargon, unnecessary details and acronyms. Promote the business's contribution to the community.

As a parallel to recruiting part-time faculty in occupational education, Rothwell and Sredl (1992) suggested various types of industrial recruitment by Human Resource

Development. The appropriate method or combination of methods of recruitment depends largely on the nature of the opening. Sources of recruitment can be passive, as in media advertising to active, as in personally targeted interviews.

A unique program for recruiting future teachers via summer academies holds promise as another source of supply (Holifield, Bradley, Strickland, & Carroll, 1994). The College of Education at Arkansas State University (ASU) had a problem common to colleges of education at many universities: recruiting academically promising students into the teacher education program. Although the college received praise for its recruitment efforts, a National Council for the Accreditation of Teacher Education (NCATE) review suggested that there was a weakness in recruiting applicants from diverse economic, racial, and cultural backgrounds (Holifield, et al.). As a result, ASU established a summer academy for future teachers as a recruitment strategy to attract academically-able high school students from a variety of ethnic backgrounds. Although not directly related to the recruitment of part-time faculty in occupational education, a modification of this program offers interesting possibilities in attracting and preparing potential part-time faculty from industry through exposure to occupational classes offered at community colleges. This may take the form of an observer, or as a guest participant of the instructor.

The first contact between the institution and the part-time faculty member is frequently at the recruitment and hiring stages. The tone for employment relations is also set early in the employment relationship (Gappa & Leslie, 1993). Murray (1994) suggested that organized public relations efforts attract more students. Similarly, such efforts can be valuable by increasing the number of applicants for part-time occupational instructors. To select the best applicant, it is necessary to compile a list of finalists from the initial list of applicants. Employment interviewers should meet with the most promising candidates. Because full-time faculty members would find their workload increased if they had to compensate for the shortcomings of an incompetent member, they

too must be a part of the selection process. Interviewers should examine work samples and portfolios. Applicants selected for interviews must demonstrate appropriate knowledge and skills. This step will narrow the list of candidates still further. Since self-efficacy is an important indicator of teacher effectiveness, interviewers should ask applicants their perceived ability to be an effective instructor. After the successful candidate has been chosen, the unsuccessful candidates must also be notified (Cohen, 1969; Rothwell & Sredl, 1992).

The list of finalists should be a representative composite of the kind of person needed to do the job. Once this is done, sorting out applicants should not be difficult. Resumes can be useful, but they usually focus on past education and experience, rather than on competency. However, it is usually easy to determine from the applicants' background whether they are likely to possess the needed skills (Rothwell & Sredl, 1992).

Murray (1994) also suggested an important part of the recruitment effort be the encouragement of the new employee to seek satisfaction once hired. Every complaint received is a legitimate concern and gives reason to evaluate and improve service.

Although the literature does not specifically mention the connection between affirmative action recruitment and the recruitment of occupational specialists from business and industry, there is a similarity between the two. Because of the unique demands of industrial skills, the demand commonly outweighs the supply. Recruitment of part-time occupational faculty may have the same implications of recruitment difficulties as for underrepresented minorities. Special proactive recruitment procedures used in affirmative action programs, such as personal invitation and follow-up, may apply to part-time occupational faculty recruitment (Opp & Smith, 1994).

Roueche, et al. (1995) summed up the recruitment process: "If good teaching is the hallmark of American community colleges, then colleges should bring serious attention to the critical steps of identifying those who can best deliver it" (p. 58).

2.15 Faculty Development: Indicators of Effectiveness

Although recruitment practices should assure that all part-time instructors are qualified in their profession, such practices do not guarantee success in the classroom. Another possible barrier to teaching is the perception of teaching ability. Rice (1982) suggested that while being occupationally experienced and competent is vital to a technical career. Part-time teaching it does not, by itself, assure success as an educator. Instructors also must master the essential professional skills of teaching adult learners. The combination of teaching skills and craft skills enhances the probability of successful instruction.

Because part-time faculty in occupational education are employed primarily for their professional competence rather than for their pedagogical training, many instructors lack the teaching skills and teaching experience necessary for effective classroom presentations. Additionally, many lack training in adult education, though most of the students they teach are adults. The development of effective part-time occupational instructors must be a priority in faculty development considerations (Lankard, 1993).

Effective instruction often depends upon the adequacy of the support and services which a community college provides for its faculty. Grymes (1976) suggested several methods of supporting teaching effectiveness: (a) recruitment, (b) orientation, (c) supervision, (d) support, (e) evaluation, and (f) faculty development opportunities.

Although there were indicators of successful teaching and components of teaching excellence, there were no clear definitions of national standards for performance. DeSantis (1980) reported there was no uniform pattern for helping part-time occupational faculty member to improve effectiveness. Each institution independently recruited, oriented, and evaluated its part-time faculty using whatever campus resources it could marshal for establishing standards for performance. Hammons (1979) and Jamerson (as cited in Eliason, 1980) posited effective part-time faculty not only need to have subject

matter expertise, they also need to be familiar with learning theory, lesson planning, curricula strategies, evaluation techniques and professional ethics.

Many community colleges, however, have been slow to develop appropriate plans for consistent use in these areas. Other colleges cite recruitment as the first phase of determining faculty effectiveness (Ashworth, 1988). As administrators determine the best course of action in using part-time faculty, it is necessary to understand the indicators of effective part-time faculty. Research in teacher excellence suggests that a combination of five key factors yield high quality teaching. An effective instructor must be able to: (a) demonstrate subject knowledge and competence, (b) plan, organize, and prepare relevant teaching strategies, (c) motivate students, and (e) communicate effectively (Findley, 1995; Harris & Parsons, 1975; Oser, Dick, & Party, 1992; Thompson, 1984).

A triangulated study by Donaldson, Flannery, and Ross-Gordon (1993) combined, recorded, and reanalyzed data that examine the perceptions of adult college students on effective teaching. This study compared the research findings with the current literature on traditional college student's perceptions of effective teaching as reported by Feldman (1988). These findings suggest additional elements of effective teaching are: (a) flexibility, (b) being a good role model, (c) adapting to meet diverse needs, (d) dedication, (e) being open-minded, and (f) warm.

According to Galbraith and Shedd (1990) part-time instructors tend to teach the way they were taught or the way they wish to learn themselves, without regard for appropriate instructional strategies. Miller (1979) and Baker, et al. (1990) suggested that the employment interviewer could detect the potential for effective teaching during the recruitment process. Even if an applicant had never taught in a formal setting, it is important to elicit how one might teach a class, given the opportunity. Considering the diversity of the adult learner, however, part-time instructors should participate in faculty development activities to enhance their instructional knowledge base, skills, and

proficiencies. Building skill and proficiency in all faculty members is paramount if the institution is an effective contributor to the teaching and learning process.

Galbraith (1989) and Lankard (1993) found the instructor may know the subject but lack teaching skills. In addition, the instructor may be highly effective with full-time, well prepared, and highly motivated students, but may be unable to adapt to part-time adult learners with special needs and concerns. Galbraith suggested three broad categories of attributes and skills that are essential for the instructor of adult learners:

1. Interpersonal Skills. The instructor must possess personality characteristics and interpersonal skills that demonstrate caring, trust, and encouragement. The instructor should be self-confident, informal, enthusiastic, responsive, and creative.
2. Instructional Planning Skills. The instructor must be able to understand and implement educational programs through an interactive and interrelated mechanisms. This includes a needs assessment to identify gaps between the learner's current and desired proficiencies. Effective instructors must be able to identify, select and modify educational objectives to meet the needs of the students and be able to select and organize learning activities that will meet the intended outcomes. The final instructional planning skill is being able to effectively evaluate student performance and outcome.
3. Teaching and Learning Transaction Skills. To assist in causing an effective educational encounter, the instructor must acquire skill in building supportive and active educational climates, and provide challenging teaching and learning interactions. Instructors must be aware of the physical environment in which learning takes place. Physical facilities should be comfortable and conducive to learning, with minimum distractions.

Knox (1986) suggested it was also necessary to establish a receptive psychological climate. It should be supportive, challenging, friendly, informal, and open without being threatening and condescending. The instructor should also provide

interactions that are active, challenging, and supportive. The most important component of teaching and learning transaction skills is to develop and organize educational encounters. Such encounters require the instructor and the adult learner to think and act critically and reflectively (Brookfield, as cited in Galbraith & Shedd, 1990).

Higgins, et al. (1994) found that the most important characteristic of successful community college instructors is to have a genuine interest in working with a diverse student clientele. Effective instructors focused as much on the interaction with students as on the transmission of course content. Since they participated in, or at least had an appreciation for other aspects of their profession, effective instructors were multidimensional in their interests and activities.

Practically all interviewees suggested mentoring and apprenticeship programs for better teacher preparation. They also suggested that prior teaching experience would be extremely helpful. Many interviewees who taught in occupational and technical programs believed that practical experience in their respective areas of expertise was important (Higgins, et al., 1994).

When asked to specify their strongest assets as teachers, interviewees most frequently indicated that their strengths were their concern for students and their ability to work with students possessing a wide range of abilities. Specific qualities mentioned were patience, sense of humor, knowledge of the adult learner, flexibility and adaptation to new course content or new teaching schedules, communication skills, and respect for and access to the student (Higgins, et al., 1994).

Subjects from the Higgins, et al. (1994) study were full-time faculty members and there is little data in the area of effectiveness using part-time faculty. However, the Higgins, et al. study is relevant to part-time instructors in occupational education as their findings represent an initial effort to profile potential faculty members in two-year colleges. Their interests, talents, and training should fit well with the missions of the community college. As part of institutional long-range planning, administrators and

faculty can develop strategies for selecting new part-time faculty. An institution may begin to build its own set of indicators of the qualities that will foster successful instructors. Administrators can accomplish this by determining the specific kinds of professional experiences, personal qualities, and expertise that applicants for part-time faculty positions should possess to be effective. Applicants must be able to demonstrate skill on the job. They should also offer evidence that they both enjoy and value working with diverse students.

Agne (1992) suggested that caring was an important component of effective teaching. Although caring is not a pedagogical strategy, it adds another dimension for teaching effectiveness. Unlike many variables, caring is not a single measurable technique, but a deep emotional belief that pervades a teacher's thought and behavior. Agne also suggests that teacher development programs do not emphasize the need to assess, clarify, or change the beliefs of instructors. Lankard (1993) concluded that the improvement of instructional quality of part-time faculty consisted of four steps:

1. Orientation. Orientation is the most critical phase in developing employee loyalty, commitment, and productivity. Part-time instructors need know the policies and procedures through facility tours, a complete syllabus for each course, a handbook answering often-asked questions, information about student evaluation, and performance expectations of instructors and students. Mentoring programs that pair full-time and part-time instructors are also helpful in orienting new part-time faculty.
2. Education and Training. There are three major forms of training that are valid mechanisms of obtaining proficiency: (a) on-the-job training, (b) inservice training, and (c) graduate education degree programs.
3. Evaluation. The conditions of faculty evaluation must be determined by department or division administrators and clearly communicated to part-time instructors when they are hired. Peer observations and reviews, supervisor reports, mentor interviews, interactions on the job, and inservice training sessions provide opportunities

for relevant responses from experienced staff and supervisors to help improve the quality of instruction.

4. Administrative Support. Spotlighting part-time instructors and their accomplishments throughout the community college gives testimony to the importance of their role. Part-time faculty appreciate an occasional nonthreatening visit by the division chair, dean, or president when accompanied by a few words of genuine interest. Pay and benefits should be topics of continual review and should eventually be comparable to those received by full-time for equal qualifications and equal work.

One of the best means for gauging effectiveness in teaching occupational curricula is to obtain candid and anonymous evaluations from employers of graduates of occupational programs. These evaluations provide a benchmark for the measurement of educational effectiveness among various curricula (Blai, 1976).

Since occupational instructors are in the unique position of grooming students for the world of work, additional indicators of effectiveness include the ability to engage in some guidance activities. Follow-up is another important element of effectiveness as it helps determine student performance on jobs in which they are subsequently employed (Roberts, 1965).

A successful method of improving teaching effectiveness is the use of a faculty development grants program. This program provides a small amount of funding for full- and part-time instructors to pursue various projects that improve classroom instruction. This program not only helps develop effective instructors, it also demonstrates the institution's genuine commitment to a high level of professional support to its faculty (Brown, 1982).

Cline (1993) argued that success in the workplace does not necessarily translate to the classroom. Instructional administrators should bear the responsibility of strengthening the role and effectiveness of part-time faculty. Areas that part-time faculty may need

support are planning course objectives, make learning meaningful, understanding the specific expectations of the college, and meeting the nature of teacher effectiveness.

2.16 Minimum Standards for Employment

Since the discovery of possible barriers to teaching may impact the minimum standards for part-time employment, it is necessary to examine hiring criteria. Occupational programs provide the means for gainful employment and the success of such programs largely depends on the effectiveness of highly skilled and knowledgeable instructors. Applicants should be able to demonstrate the skills of their occupation and explain technically related knowledge in language that is understandable to students. They should be occupationally competent and ultimately, educationally proficient (Reed, 1967; Roberts, 1965). Reed further suggested that an effective screening tool in the selection of instructors in occupational education was to use trade competency examinations.

The employment goal of community colleges is to maximize the quality of instruction provided by the institutions. Given this objective, the decision to hire part-time instead of full-time instructors is justified when students, programs, regular staff, and institution can benefit. Unless this justification occurs, the educational wisdom of substituting part-time faculty members for full-time faculty members seems difficult to defend (Friedlander, 1980).

To meet the need for program flexibility and occupational relevancy, recruitment of this educational resource must be comprehensive and systematic (Harris, 1980; Parsons, 1985). To meet program flexibility and relevancy, it is necessary to clearly state the job description and the qualifications for the part-time position. It is also necessary to state the relationship or commitment between the part-time employee and the institution. When applicants apply for a part-time teaching position, they must know what the

expectations of the job and how it fits into the institution's plans (Brown, 1982).

In order to find and employ these key assets, there should be formal employment criteria for part-time faculty. Specific criteria that apply to part-time faculty in occupational education are (The California Community Colleges Academic Senate, 1989; Miller, 1979):

1. The candidate should hold at least an Associate's degree with appropriate work experience for occupational programs.
2. The candidate should hold or be able to obtain occupational certification, or proper teaching certificate if required by a specific state.
3. The candidate should provide positive recommendations from previous employers and others.
4. The candidate should be a person of integrity.
5. The candidate should have a positive scholastic record, especially one which exhibits consistent improvement.
6. The candidate should have a personal interview with the division or department chair, personnel director, or dean of instruction.
7. The candidate should be enthusiastic about wanting to teach students.

Although not specifically mentioned by Miller, one should consider the importance of the willingness of new part-time hires to participate in faculty development programs. This will enable them to learn effective pedagogy and help them understand the culture of the community college. However, community colleges, not only must be willing to encourage and support part-time faculty in these programs, they must also put forth the effort necessary to attract and keep qualified technical specialists.

3. Methodology

3.1 Introduction

As discussed in Chapters One and Two, there is a shortage of qualified technical instructors at community colleges in new and emerging technologies. The purpose of this study was to identify barriers that may influence the decision of semiconductor specialists to teach part-time at community colleges. With barriers of interest in teaching, self-efficacy, awareness of teaching opportunities, and faculty development being identified, results of this study may be used by community colleges to overcome these barriers and thereby increase the pool of part-time technical faculty members. _

The semiconductor industry is an emerging technology of global importance. In Oregon, for example, there are 25,997 employed in this industry. This represents 58% of Oregon high-tech employment (Semiconductor Workforce Consortium, 1995). It is therefore appropriate to examine barriers that may affect potential instructors of technical education in this industry.

3.2 Survey Rationale

There are numerous semiconductor manufacturers in the pacific northwest that belong to, or are associated with, the Semiconductor Workforce Consortium (Consortium), from which data are drawn for this thesis. Consortium members, comprised of semiconductor manufacturers and community college partners, expressed an urgent concern for industry specialists who can teach technical subjects. Sharp Microelectronics Technology, the survey test site, and SEH America, the primary respondent site, are located in Vancouver, Washington and interact with the Consortium. The Consortium includes these manufacturers in the Portland, Oregon region.

Since there were no previously designed instruments to assess barriers to teaching by technical specialists, a new instrument was needed. A review of literature, a panel of experts, and a test site from within the semiconductor industry provided the substance and structure for the survey instrument used in this thesis. This survey, as shown in Appendix A, identified characteristics of potential part-time faculty in the semiconductor industry and determined possible barriers to teaching. The survey contained five investigative criteria:

1. Characteristics of potential part-time instructors.
2. Interest in teaching.
4. Self-efficacy.
3. Awareness of teaching opportunities.
5. Faculty development.

As expected, there were differences in the results from the test site at Sharp and the primary respondent site at SEH America. However, trends were consistently similar, thus indicating internal reliability.

3.3 Theoretical Framework

The purpose of the survey is to discover factors that influence the decision of technical specialists to teach their professional skills part-time at community colleges. There are several factors that could influence such a decision upon which the theoretical framework could be based. These areas include career decision (Hackett & Betz, 1981), selection and staffing, training and development (Rothwell & Sredl, 1992), and self-efficacy (Bandura, 1977). However, since the theory of self-efficacy is a fundamental component for making a work-related decision, the theoretical framework for this study is

based on Bandura's (1977) seminal work on self-efficacy. Bandura's theory is then adapted to career development (Hackett & Betz, 1981; Lent, Brown, & Hackett, 1994). Theoretical support and methodological direction for the development of this study are based in part on the following premises:

1. Factors of attention, expectancies, and beliefs play an important role in the acquisition of new behavior.
2. People who perform poorly may do so because they either lack the skills or have the skills, but lack the efficacy to use them.
3. Self-efficacy influences choice of activities, the amount of effort expended, and persistence in the face of obstacles.
4. Self-efficacy is a better predictor of success in the performance of an activity than actual innate ability.
5. Self-efficacy is a construct found effective in altering avoidant behaviors.
6. Self-efficacy is applicable to other disciplines of human behavior.
7. The theory of self-efficacy is best applied to domain-specific contexts, such as making the decision to extend one's career from the technical workforce to teaching those same skills to others.

Before complex research questions can be answered through relationship research and experimental research in education, it is necessary to determine the characteristics of the individuals and situations involved through descriptive research. This study uses the paradigm of descriptive research to investigate characteristics of barriers to teaching that technical specialists may encounter. Since there are many uncontrolled variables, no generalizations can be made. Therefore, this study is exploratory and descriptive, not inferential. Not only does this descriptive research yield useful data for practical application and implementation, it also provides a solid foundation for possible future research (Borg, Gall, & Gall, 1993; Fowler, 1993).

3.4 Survey Development

Based upon a review of literature, a survey was developed to address important barriers of teaching for technical specialists. Specific areas of concern were: (a) interest in teaching, (b) self-efficacy, (c) awareness of teaching opportunities, and (d) faculty development. The survey used three types of questions in order to gather differing sorts of data: Likert scale, multiple choice, and check correct response(s). To accommodate atypical responses, most questions had an *other* response option.

To further assess the content validity of the survey, a panel of ten experts was asked to critique the survey prototype. Table 3.1 lists members of the review panel.

Table 3.1 Panel of Experts

Expert	Organization	Expertise
Kelli Ambuehl	Sharp Microelectronics Technology	Semiconductor Personnel
Ronald Daugherty	Western Center for Community College Development	Community College Faculty
Thomas Fahey	OKI Semiconductor	Semiconductor Personnel
Gail Hackett	Arizona State University	Self-Efficacy
Cheryl Hinerman	Intel Corporation	Semiconductor Personnel
Robert W. Lent	Michigan State University	Self-Efficacy
Gary Miller	Hewlett Packard Company	Semiconductor Industry
Donald O. Prickel	Oregon State University	Self-Efficacy
William Shelton	SEH America, Inc.	Semiconductor Personnel
Sam Stern	Oregon State University	Community College Faculty

After the members of the panel of experts offered their critical reviews, relevant modifications were incorporated. These revisions included rewording of questions and response categories. Based on the feedback from this panel, 110 engineers and technical managers at Sharp Microelectronics Technology (Sharp) received the revised survey for testing internal reliability. Due to company policy and/or infringement on employee time, other test sites were not available for this study. Of the 110 subjects who received the prototype survey at Sharp, 23.6% (26 respondents) returned the survey for analysis. The relatively low response rate may be attributed to the low priority given by the survey coordinator at Sharp. Another plausible reason for the low rate of return was many of those who were not interested in teaching part-time did not return their surveys.

Aggregate responses suggested that some questions were generally inappropriate for the intended subjects. The survey originally listed technicians as potential part-time instructors, but management at Sharp excluded technicians from survey participation. They felt that technicians had insufficient academic preparation to successfully teach part-time at the community college level. Consequently, all technician categories were eliminated and two additional engineering-related categories, manufacturing and design, were added to the final research survey. Since some respondents at Sharp were in manufacturing and design engineering, these two positions were included in the survey for the primary respondent site.

Because the primary respondent site, SEH America (SEH), needed in-house teaching information for their own use, the survey coordinator at SEH placed an urgent priority for survey completion. Respondents who were not interested in teaching were also requested to complete and return the survey to the coordinator.

3.5 Delimitations

As in the case of a single test site at Sharp, there was only one primary respondent site available for this study. The primary respondent site used in this study needed information about potential in-house instructors, so they were willing to participate, provided the survey contained potential in-house instructor information. Once agreed upon, The population for this study consisted of engineers and technical managers from Shin-Etsu-Handotai America, Inc., commonly referred to in the U.S. market as SEH America (SEH). SEH is located at 4111 NE 112th Ave. Vancouver, Washington. Additional delimitations of this study were:

1. Respondents had at least a baccalaureate degree in engineering or related technical field and were engaged in an engineering-related capacity within the semiconductor industry (Appendix B). Capacities included engineering-related positions, such as:
 - a. Equipment engineer.
 - b. Facilities engineer.
 - c. Manufacturing engineer.
 - d. Process engineer.
 - e. Quality assurance engineer.
 - f. Test engineer.
2. Respondents with a baccalaureate degree in a non-engineering field were considered qualified if they had at least five years experience in an engineering-related position related to the semiconductor industry.
3. Respondents may, or may not have been interested in teaching part-time for their local community college.

3.6 Background of Participating Companies

The survey test site, Sharp Microelectronics Technology, Inc., was founded in 1986 as a wholly owned subsidiary of Sharp Corporation, Japan. The Sharp facility in Camas, Washington, is responsible for developing some of the industry's fastest static RAMs (Random Access Memory) chips and high performance First-In First-Out memory devices. Every phase of the integrated circuit design, development, and testing is handled at the Camas facility (Sharp Microelectronics Technology, 1995).

The primary respondent site, SEH America, was founded in 1979. SEH is a subsidiary of Shin-Etsu-Handotai Ltd. (Shin-Etsu), a Japanese-based conglomerate of more than 100 companies. Shin-Etsu has other silicon wafer manufacturing plants located in San Jose, California; Dallas, Texas; and Sparta, New Jersey. Other plants are located in Japan, Scotland, and Malaysia. SEH employs over 1200 people at its Vancouver, Washington facility. Active college recruiting for technical specialists in mechanical and chemical engineering and material science occurs at the University of Washington, Washington State University, Oregon State University, Portland State University, and the University of Idaho. Their wafer products are used by virtually every major semiconductor manufacturer, resulting in a worldwide capital expansion of over \$1 billion in the last five years (Dun & Bradstreet, 1996; Shin-Etsu SEH America, 1995; Smith, 1993).

Silicon wafers purchased from SEH are then etched by their customers with circuit patterns and sliced into miniature squares. These squares, or "chips" are then packaged into electronic components that are at the heart of many products, including computers, lasers, medical equipment, and appliances (Shin-Etsu SEH America, 1995).

Although SEH is not a member of the Semiconductor Workforce Consortium, it has participated regularly in this organization. The manufacturers used in this study, Sharp and SEH, participated in an earlier study which assessed the building and

strengthening of the workforce in the semiconductor industry (Semiconductor Workforce Consortium, 1995). They also wanted to participate in this study as it may help produce a greater number of qualified engineers, technicians, and operators for their own companies. Conclusions and recommendations from this study may help meet projected needs of the workforce in emerging technologies. Skilled engineers and technical managers from SEH are familiar with manufacturing skills that are necessary to produce quality products. If qualified technical specialists agree to teach the same skills to community college students on a part-time basis learning will be more closely aligned to company needs. Instructors who do not come from the ranks of current technology may be less skilled or knowledgeable in teaching emerging technologies.

3.7 Survey Administration

Approval to administer the survey to SEH technical employees was received from William D. Shelton, Manager, Human Resource Development at SEH on February 12, 1996. Originally, Shelton estimated approximately 75 respondents. To account for any additional respondents not previously identified, a total of 99 copies of the survey were delivered to SEH on February 14, 1996. Respondents were asked to complete and return the survey to Shelton in one week.

Shelton attached a cover letter on SEH letterhead to each survey. It was individually addressed to each respondent for two reasons: 1. At Shelton's request, SEH wanted to identify individuals who may want to teach within their company; 2. There was a better possibility of an increased response rate. Shelton removed the cover letter from the survey before data entry and analysis, keeping anonymity intact. With survey revisions made after the primary test site results, Shelton anticipated the response rate at approximately 45, or 60%, out of the estimated 75 survey participants. This

anticipated response rate was considered very high, compared with other survey responses at SEH.

4. FINDINGS

4.1 Summary of Major Findings

Although 51% of the respondents indicated that they did not have enough time to participate in teaching activities, there were 57% who expressed interest in becoming a guest lecturer for a community college. Furthermore, 24% indicated an interest in becoming a part-time instructor for a community college. This suggests that there are from 18 to 43 respondents who may qualify candidates as technical instructors for community colleges.

At least 82% of the respondents were very confident or completely confident in their performance on the job. Similarly, 79% perceived themselves as highly efficacious when they contemplated teaching if they had assistance in faculty development.

With such positive responses, it was surprising to note that 83% of those surveyed were unaware of the need for part-time technical teaching positions at community colleges. This suggests the need for more effective communication between community college partners and industry.

4.2 Survey Administration

Before distributing the surveys Shelton identified and targeted additional qualified respondents for a total of 108. Additional survey copies were duplicated at SEH expense and distributed on February 16, 1996. Although Shelton asked respondents to complete and return the survey in one week, completed surveys were accepted through March 9, 1996 to maximize the number of responses accepted for data analysis.

To facilitate a timely response, a follow-up telephone call was made to Shelton, the coordinating administrator to encourage continued follow-up with participants.

Shelton then collected the survey responses and forwarded them to the researcher for data input and analysis.

4.3 Response Results

Out of 108 surveys distributed, 76 (70.4%) were returned. According to the delimitation criteria, there were 100% valid respondents. These data, therefore, are the basis for these findings presented in this study.

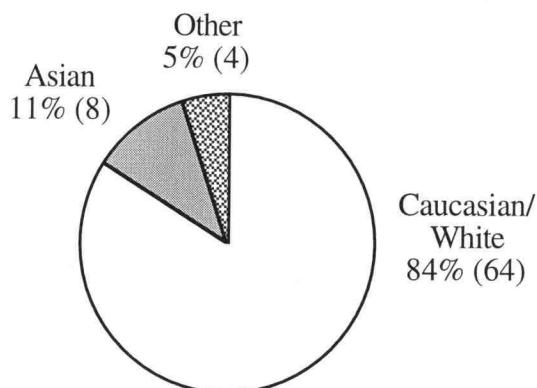
4.4 Data Coding and Analysis

Data obtained from this study were coded and entered into the spreadsheet, Quattro Pro, formatted to dBASEIII, and then exported and analyzed with the Statistical Package for the Social Sciences (SPSS) for Windows.

4.5 Demographics

To better understand the characteristics of the potential pool of part-time instructors, demographic data is included in this study. Characteristics of technical specialists at SEH include race (Figure 4.1), gender, age (Figure 4.2), and education (Figure 4.3). Additional demographic data provide information of years of overall experience in the semiconductor industry, years of experience in their present position, length of shift, and management status.

Figure 4.1 Race/Ethnicity



Males comprise 88.2% employed in an engineering-related capacity at SEH, compared to the national labor force rate of 75% males. The mean age is 33 years (Figure 4.2). Most respondents (67.1%) had attained at least a bachelor's degree in an engineering discipline (Figure 4.3). Respondents had an average of 6.4 years experience in the semiconductor industry with 4.1 years at their present positions. Respondents normally worked a nine hour shift, five days a week. SEH employs 34.2% of their technical staff in management positions.

As a group, the respondents are highly educated. More than two-thirds (67%) hold at least a bachelor's degree, while nearly a third (29%) hold a master's degree. Those holding doctoral degrees account for 4% of the respondents. As one would expect, such a high level of education within the semiconductor industry is not uncommon. The education level of technical specialists within SEH America may, in fact, be somewhat lower than others in the industry. For example, the levels of education with a similar population found at Sharp, the test site for the survey, suggest a higher level of education. Although only 50% of Sharp's technical specialists hold a bachelor's degree and 20% hold a master's, 30% hold a doctoral degree, compared to 4% doctoral degrees of

Figure 4.2 Age Distribution

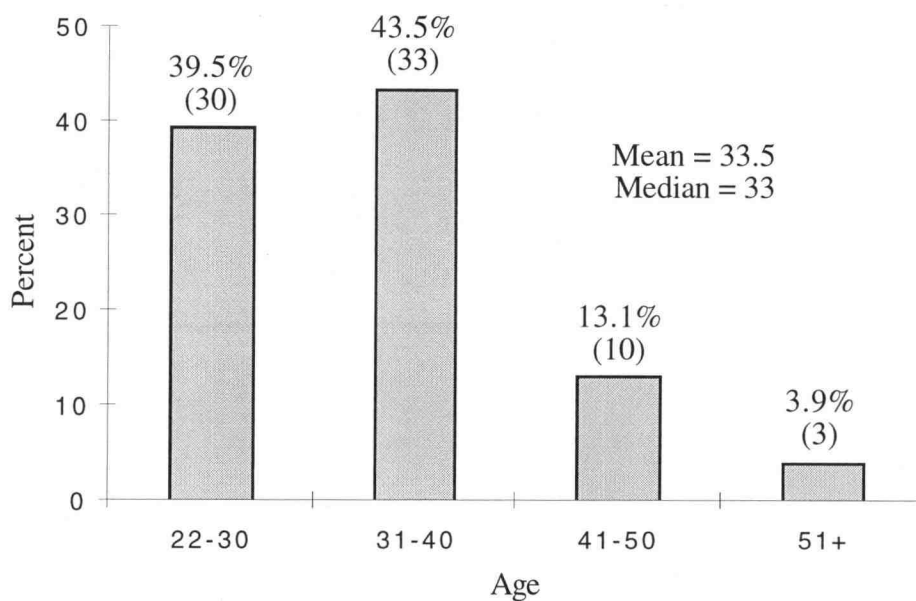
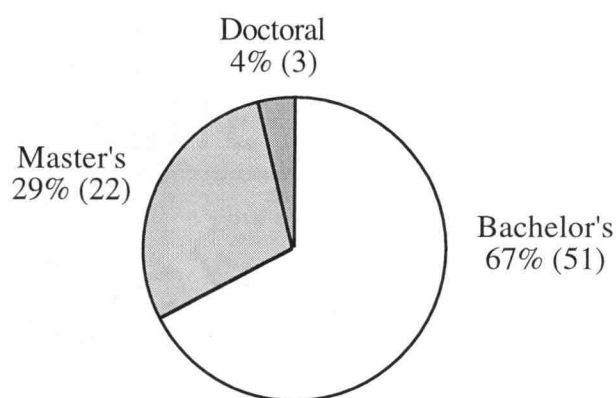


Figure 4.3 Level of Education



respondents at SEH. However, data from both sites, SEH and Sharp, suggest similar trends. It appears that the higher the education, the greater the confidence and self-efficacy. This further supports the internal reliability of the survey instrument.

SEH America employs technical specialists from a wide variety of disciplines, shown in Table 4.1. As expected, almost all respondents received their degrees in engineering or scientific fields. Respondents listed in Table 4.1 as *Other* included the

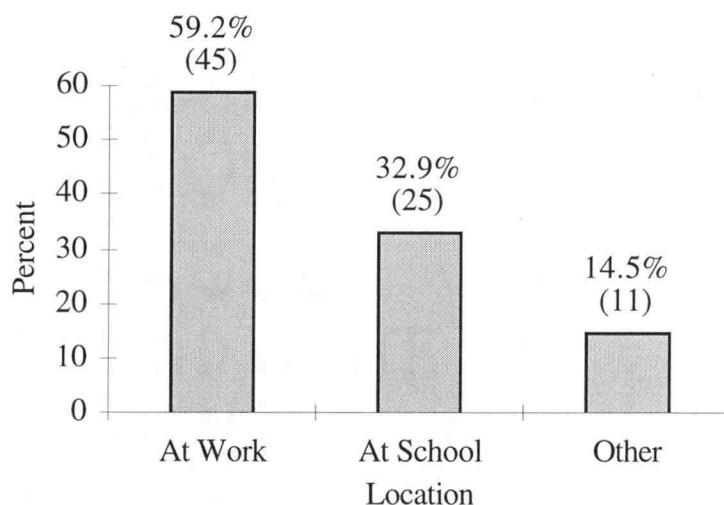
Table 4.1 Academic Majors

Major	Respondents	Percent
Mechanical Engineering	20	26.3
Chemical Engineering	18	23.7
Engineering Management	6	7.9
Materials Science Engineering	6	7.9
Chemistry	5	6.6
Business Administration	2	2.6
Ceramic Engineering	2	2.6
Manufacturing Engineering	2	2.6
Metallurgical Engineering	2	2.6
Physics	2	2.6
Other (1 respondent per major)	11	14.5
Total:	76	100%

following academic majors: civil engineering, computer engineering technology, electrical engineering, engineering science, environmental health, geological science, industrial engineering, materials science engineering, professional education/earth science (interdisciplinary), sociology, and structural/facilities engineering. The majority of respondents (75%) had previous experience in teaching or training others. Among those with previous teaching experience, about 60% (59.2%) had experience teaching or

training others at work, as shown in Figure 4.4. About a third (32.9%) taught others at an educational institution. Considering the number of graduate degrees, it is likely that many of those who had experience teaching in an educational environment, did so as tutors or graduate assistants. Comments from *Other* in Figure 4.4 suggest that some respondents gained teaching experience while serving in the military or Peace Corps.

Figure 4.4 Previous Experience in Teaching or Training Others



4.6 Identifying Barriers to Teaching

4.6.1 Interest in Teaching

Respondents who showed interest in teaching part-time, either for their company or for a community college, were asked to identify their main reasons for wanting to teach, as shown in Table 4.2. It is noteworthy that the two most frequently reported responses for wanting to teach was the *personal satisfaction of teaching others* (60.5%) and *teaching might be enjoyable* (43.4%). Both reasons suggest an altruistic interest in working with others.

Table 4.2 Reasons for Wanting to Teach Part-Time

Reasons for Wanting to Teach	Respondents	Percent
Personal satisfaction of teaching others	46	60.5
Teaching might be enjoyable	33	43.4
Income	27	35.5
Teaching would help my career advancement	24	31.6
My expertise would help strengthen my company	21	27.6
My expertise would help strengthen the community	20	26.3
I like the variety	17	22.4
I want to be a part of an academic environment	17	22.4
Confident that I would be an effective teacher	11	14.5
Other	5	6.6

When respondents were asked if they ever had an interest in teaching part-time for their employer, 44.7% (34) indicated they had. When asked if they ever had an interest in teaching part-time at a community college, 30.3% (23) indicated they had.

Table 4.3 addressed a related question. “In what capacity(ies) would you be willing to help the semiconductor industry increase the instructor pool of part-time technical instructors?” Respondents had the option of selecting one or more capacities. The majority of respondents (56.6%) would be willing to teach as a guest lecturer at a community college, while 23.7% would be willing to teach part-time. *Guest Lecturer* denotes participating in at least one class session. *Part-Time Instructor* denotes teaching at least one class per term.

Respondents who were not interested in teaching part-time, either for their company or for a community college identified their reasons, as shown in Table 4.4.

Table 4.3 Willingness to Help in Education-Related Capacities

Capacity	Respondents	Percent
<i>Guest Lecturer at a Community College</i>	43	56.6
Course Development for Company	34	44.7
Guest Lecturer for Company	32	42.1
<i>Part-Time Instructor at a Community College</i>	18	23.7
Part-Time Instructor for Company	15	19.7
Screening Committee for Company Instructors	11	14.5
Other (as adjunct professor at 4-year institution)	1	1.3
None of the Above	13	17.1

Table 4.4 Reasons for Not Wanting to Teach Part-Time

Reasons for Not Wanting to Teach	Respondents	Percent
Not enough time	39	51.3
I have too many other commitments	31	40.8
My work is too demanding	25	32.9
Not interested in teaching	7	9.2
Other	5	6.6
I lack confidence in my teaching ability	4	5.3
I lack confidence in my engineering skills	3	3.9
I lack confidence in speaking in front of others	2	2.6
Teaching doesn't pay enough	2	2.6
Poor health	1	1.3

Less than 10% (7) of the total respondents indicated that they were not interested in teaching. Approximately 51% (39) of the respondents indicated they did not have enough time to teach, others indicated they had too many other commitments (40.8%), or their work was too demanding (32.9%). This, however, suggests that some objections may be overcome if addressed on an individual basis.

4.6.2 Self-Efficacy

To address self-efficacy as a barrier to teaching part-time technical courses, levels of employee confidence were established in several areas of the decision-making process. As a group, the respondents were confident about their professional skills and abilities. They were also confident about their ability to teach if they were offered assistance in faculty development.

When asked about their level of confidence working on their current job, shown in Figure 4.5, 82% (62) responded *very confident* or *completely confident*. None reported *somewhat confident* or *not at all confident*. Figure 4.6 indicates that the perceived level of success at their professional responsibilities, or performance mastery, was also positive.

Figure 4.5 Levels of Confidence on Their Current Job

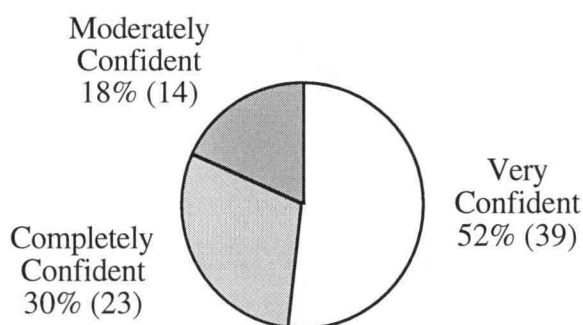
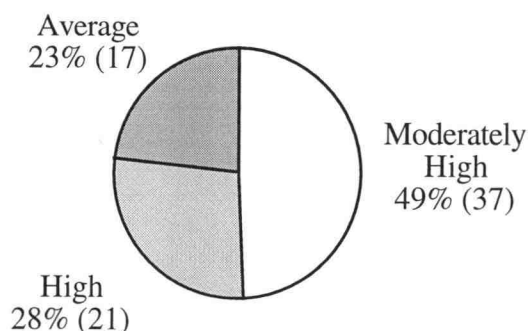


Figure 4.6 Perceived Level of Success (Performance Mastery) on the Job



The response rate was 77% (65) for *moderately high or high*. None reported *below average* or *poor*. Compared to the data received from the survey test site at Sharp, it appears that respondents answered questions candidly. Data from the questions about self-efficacy and perceptions of confidence are similar from both groups, again, suggesting internal reliability.

Figure 4.7 indicates the various levels of confidence when respondents were asked about their teaching ability *without* assistance. Figure 4.8 illustrates the various levels of confidence about teaching ability *with* assistance. As one compares *without* assistance to *with* assistance, the confidence level in teaching ability increases dramatically. *Without* assistance, 42% (32) of the respondents were *moderately* confident about their teaching ability, while 26% (20) were *very* confident. When asked about their confidence level *with* assistance, response rates increased to 55% (42) *very* confident and 24% (18) *completely* confident. Although confidence levels are relatively high in the respondents' ability to teach *without* assistance, there is a marked increase in their confidence levels when offered assistance to enhance their teaching ability. This suggests that self-efficacy increases when support is offered.

Figure 4.7 Levels of Confidence When Asked About Teaching Ability Without Assistance

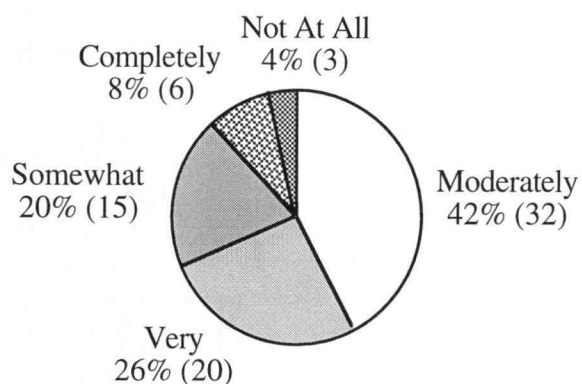
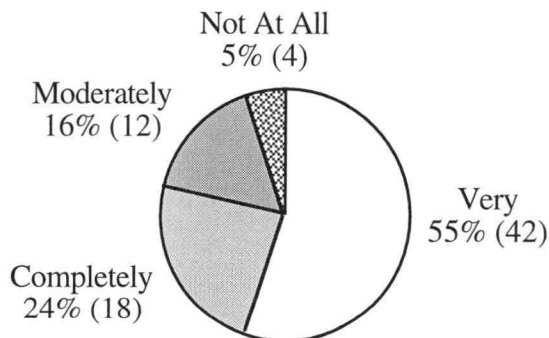


Figure 4.8 Levels of Confidence When Asked About Teaching Ability With Assistance



Technical specialists surveyed were generally confident about their professional abilities as well as their potential teaching abilities. Table 4.5 confirmed such confidence. Out of 76 total respondents, only 9% (7) reported their disinterest in teaching due to lack of confidence. Of those 56.6% (43) respondents interested in lecturing at a community college, as shown in Table 4.3, only 5% (2) respondents lacked confidence as an instructor without assistance, as shown in Figure 4.7. These data suggest self-efficacy

Table 4.5 I Don't Want to Teach Because I Lack Confidence

Group	Not Confident About Teaching	Not Confident About Speaking	Not Confident About Professional Skills	Row Total
Those Interested in Lecturing at a CC		50% (1)	50% (1)	28.6% (2)
Those Not Interested in Lecturing or Teaching Part-Time at a CC	80% (4)	20% (1)	40% (2)	71.4% (5)
Column Total (%)	57.1% (4)	28.6% (2)	42.9% (3)	100% (7)

7 valid responses; not applicable to 69 responses

may be a barrier to teaching for some, but the majority of technical specialists do not perceive self-efficacy as a barrier to teaching. Survey results, however, indicated that the levels of confidence by potential teachers would increase even further if they were offered teacher development assistance.

Although faculty development logically follows recruitment, it is interesting to note how the perceived opportunity for faculty development increases the efficacy that respondents had in their teaching ability. The contrast of teaching ability *without* assistance with teaching ability *with* assistance is striking. Table 4.6 summarizes the results from Figures 4.7 and 4.8. Although the levels of confidence of teaching ability were moderately high *without* assistance, the levels of confidence progressively increased when respondents were asked about their confidence in their teaching ability when given assistance. The possibility of faculty development assistance appears to considerably alter

Table 4.6 Levels of Confidence When Asked About Teaching Ability Without and With Assistance

	Not At All Confident	Somewhat Confident	Moderately Confident	Very Confident	Completely Confident	Totals % (respondents)
Without Assistance	4% (3)	20% (15)	42% (32)	26% (20)	8% (6)	100% (76)
With Assistance	5% (4)	-	16% (12)	55% (42)	24% (18)	100% (76)

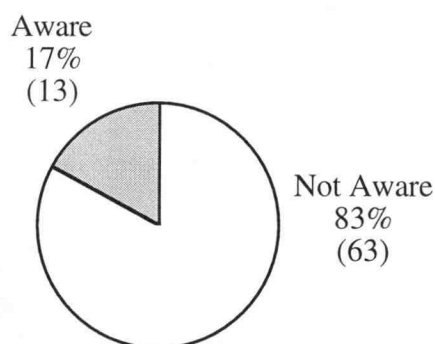
one's perception of the ability to teach confidently. This is consistent with Mager's (1992) premise that performance mastery, or the anticipation of mastery, can strengthen self-efficacy.

4.6.3 Awareness of Teaching Opportunities

Although Table 4.3 indicated over 80% of the respondents were willing to teach at a community college, either as a guest lecturer or as a part-time instructor, Figure 4.9 indicates that most (82.9%) were not even aware that part-time teaching positions were available at community colleges for technical specialists in the semiconductor industry.

Respondents who were aware of such teaching opportunities, indicated where they first learned that part-time technical teaching positions were offered by community colleges, as shown in Table 4.7. However, with only 16.9% (13) responding, the data suggest no clear marketing strategies to increase the awareness of part-time technical teaching positions. Since all of the respondents had at least a baccalaureate degree and

Figure 4.9 Awareness of Teaching Opportunities at Community Colleges



only 3.9% (3) had a part-time teacher while attending community college classes, one can infer that most attended a four-year institution, while few attended community colleges.

Table 4.7 First Learned About Availability of Part-Time Teaching at a Community College

Circumstance	Respondents	Percent
Had a part-time teacher while attending a community college	3	3.9
Newspaper	3	3.9
Co-worker teaches part-time at a community college	2	2.6
Referral by someone already working part-time at a community college	2	2.6
Checked with local community college for teaching positions	1	1.3
Invitation to teach by someone at a community college	1	1.3
Other (friend/associate taught several years ago)	1	1.3
Total:	13	16.9

4.6.4 Faculty Development

An important extension to interest in teaching, self-efficacy, and awareness of teaching opportunities in the decision-making process, is the development of teaching skills. To increase the pool of part-time technical faculty community colleges must provide tools to interested technical specialists which will help increase student learning. Survey participants were asked if they would be willing to participate in programs which would help develop their teaching skills, as shown in Figure 4.10.

Figure 4.10 Willingness to Participate in Programs to Help Develop Teaching Skills

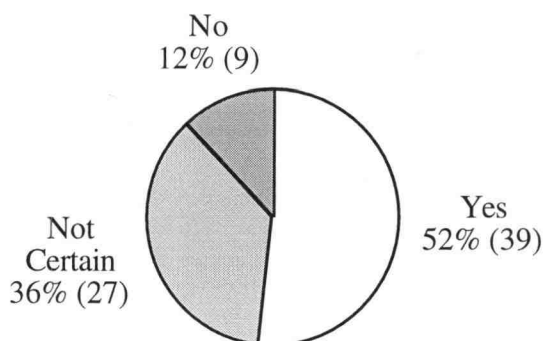


Figure 4.11 illustrates responses when asked if they would be willing to work with a mentor to help develop their teaching skills. Response rates Figure 4.11 were similar to Figure 4.10, suggesting both methods of participation in faculty development would be helpful. More than half (52%) of all respondents indicated willingness to participate in teacher development programs.

Figure 4.11 Willingness to Work With a Mentor to Help Develop Teaching Skills

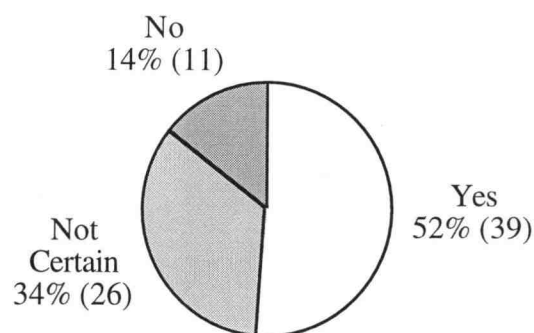


Table 4.8 reflects the perceived importance of educational tools which may be of help to potential part-time technical instructors. Data listed in this table demonstrate the need for faculty development, even for technical specialists who have prior teaching experience. In aggregate, each tool is listed in order of overall importance. The two most important educational tools listed by respondents are *content knowledge* and *how to teach effectively*. Conversely, the least important educational tools are *orientation to teaching adults* and *advising students out of class*.

These data support Lankard's (1993) concern for the importance of faculty development, since part-time faculty in occupational education are employed primarily for their professional competence rather than for their pedagogical training. Anticipation of faculty development suggests improvement of teaching effectiveness, as shown in Table 4.8. Although community college department heads, supervisors, and deans, understand the principles of teaching effectiveness, faculty development programs for part-time instructors are uncommon.

Although most survey respondents (76%) placed *content knowledge* and *how to teach effectively* as being a *very* important educational tools, the importance of other tools diminished dramatically, ranging from *updating knowledge/skills* (38%) to *advising*

Table 4.8 Perceived Importance of Educational Tools

Importance of:	% (subjects) Very	% (subjects) Moderately	% (subjects) Somewhat	% (subjects) Not Important	% (respon- dents) Don't Know
Content Knowledge	76.0% (57)	13.3% (10)	6.7% (5)	4.0% (3)	-
How to Teach Effectively	54.7% (41)	37.3% (28)	4.0% (3)	4.0% (3)	-
Updating Knowledge/Skills	37.8% (28)	41.9% (31)	16.2% (12)	4.1% (3)	-
Lesson Planning	28.0% (21)	50.7% (38)	14.7% (11)	6.7% (5)	-
Having Support from Faculty	28.0% (21)	46.7% (35)	22.7% (17)	1.3% (1)	1.3% (1)
Having Resources for Help	26.7% (20)	48.0% (36)	21.3% (16)	2.7% (2)	1.3% (1)
Having Support from Administrators	26.7% (20)	40.0% (30)	25.3% (19)	6.7% (5)	1.3% (1)
"Values" of Teaching/Learning	23.0% (17)	35.1% (26)	23.0% (17)	5.3% (4)	13.2% (10)
How to Evaluate Students	20.0% (15)	37.3% (28)	36.0% (27)	6.7% (5)	-
Orientation to Teaching Adults	13.3% (10)	36.0% (27)	38.7% (29)	9.3% (7)	2.7% (2)
Advising Students Out of Class	10.7% (8)	42.7% (32)	36.0% (27)	8.0% (6)	2.7% (2)

students out of class (11%). Other educational tools, such as lesson plans, support from faculty and administrators, values of teaching and learning, evaluation of students, and orientation to teaching adults, were generally perceived less important. These data strongly suggest a program of faculty development is necessary to broaden the understanding of many technical specialists so they can use educational tools effectively.

5. DISCUSSION, CONCLUSIONS, AND IMPLICATIONS

5.1 Summary of the Problem

There is a shortage of qualified community college technical instructors in new and emerging technologies. The purpose of this study was to identify barriers that may influence the decision of semiconductor specialists to teach part-time at community colleges. Results of this study may be used by community colleges to overcome these barriers and thereby increase the pool of part-time technical faculty members. _

The focus of this study was to investigate the influences that may affect one's decision to teach in technical education. Although qualified technical specialists from industry appear to be a good teaching resource, there are several variables that may influence qualified applicants to seek technical instructor positions. In addition to providing demographic data, this study identified four primary barriers that could affect their decision to teach: (a) interest in teaching, (b) self-efficacy, (c) awareness of teaching opportunities, and (d) faculty development.

5.2 Demographics

5.2.1 Discussion

By end of the 1990s, nearly 75% of U.S. jobs will require postsecondary education for job entry. To meet the challenges of workforce preparation for the 21st century, community colleges must provide current, relevant programs in occupational and technical education. Because of the need for industrial relevancy, many technical instructors will teach part-time while working full-time in industry.

The dramatic expansion of the semiconductor industry in Oregon is placing an additional burden on workforce preparation and instructional staffing. In the Portland area alone, the value of pending and potential semiconductor chip and wafer plants exceed \$10 billion. Within the next five years, this industry will create nearly 7,500 new jobs in Oregon. A major challenge for educators is to effectively train technical specialists to meet the needs of this industry.

Data drawn from this study suggest that potential part-time technical instructors in the semiconductor industry are well-educated individuals, with at least a baccalaureate degree in an engineering or scientific discipline. These data further suggest potential part-time technical faculty have several years of experience on the job. As expected, this experience is useful in dealing with the practical theory and application of job performance when presented in a classroom environment. The technical disciplines are male-dominated at the primary respondent site, with very little minority representation.

5.2.2 Conclusions

Based on a review of literature and survey data, technical instructors will usually have at least a baccalaureate degree in an engineering or scientific discipline. Although experience levels will vary, educators can expect to establish a pool of qualified part-time instructors with several years of practical work experience.

Because these technical disciplines are male-dominated, with very few minorities represented, the majority of instructors will be white males. However, as Parsons (1980) suggested, there should be a systematic needs analysis and targeted recruitment, similar to those found in the recruitment of minorities or athletes.

5.2.3 Implications

A clear understanding of applicant demographics will enable educators to anticipate filling the pool of part-time technical instructors with well-qualified specialists. Teaching expertise, however, will depend largely on the quality of service and support offered to part-time instructors by community colleges.

5.3 Interest in Teaching and Awareness of Teaching Opportunities

5.3.1 Discussion

Although interest in teaching and awareness of teaching opportunities were treated separately in earlier chapters, the two research components meld into this discussion. The lack of effective communication between community colleges and industry appears to be a major barrier in securing part-time technical faculty. Ironically, even though survey results revealed high levels of professional experience, interest in teaching, and various teaching experiences, an important finding of this study was the overwhelming lack of awareness (83%) of teaching opportunities at community colleges. This is not unexpected, however, as all survey respondents had at least a baccalaureate degree granted by four-year institutions. Although not specifically addressed in this study, it is likely that most respondents received their entire formal training at such institutions. This suggests that few attended a community college and were therefore unaware of part-time teaching opportunities at these institutions. The data suggest successful recruitment and retention of part-time technical instructors can be influenced by a well-designed and implemented marketing strategy.

As the literature and survey data suggest, it is necessary to increase the awareness of technical teaching positions available. Recruitment should be proactive, not passive. Passive, or impersonal recruitment techniques are usually inadequate. Methods such as, classified advertisements, local posting of job announcements at the community colleges or industrial sites, relying on word-of-mouth, or previous contacts with part-time instructors are generally insufficient to attract qualified technical instructors.

Not only should proactive recruitment produce an increased pool of prospective instructors from specialized industries, it should also improve Affirmative Action compliance mandates by using part-time faculty. As Affirmative Action comes under new scrutiny, however, there may be a more important underlying reason for recruiting minorities. This researcher suggests that greater heterogeneity among the part-time faculty will broaden the role model potential, thereby increase minority student enrollment, and improve overall instruction.

Although the literature does not specifically mention the connection between affirmative action recruitment and the recruitment of occupational specialists from industry, there is a striking similarity between the two. Targeted proactive recruitment procedures used in affirmative action programs may apply to part-time occupational faculty recruitment. Because of the specialty nature of the semiconductor industry, with the demand commonly outweighing supply, the recruitment of part-time occupational faculty may have the same implications of recruitment difficulties as underrepresented minorities.

5.3.2 Conclusions

Interest and awareness are not the same. Interest in teaching is an internal barrier, dependent upon individual perceptions. Awareness of teaching opportunities is an

external barrier, with influences beyond control of the individual. As educators earnestly seek qualified technical specialists to place in their pool of qualified part-time instructors, industry continues its search for more operators and technicians. But the majority of qualified technical specialists are unaware of their potential role in solving both dilemmas. In general, the technical specialists surveyed are qualified for their positions, having several years of experience in the semiconductor industry and in their current positions. Many are also interested in the potential of teaching their skills to others. Conversely, while community colleges and industry attempt to resolve their respective staffing dilemmas, they appear to lack communication and marketing skills sufficient enough to recruit and retain technical instructors.

5.3.3 Implications

Until educational institutions and the semiconductor industry express their needs more fully and more clearly to each other, the staffing dilemma is likely to continue. It is not realistic or accurate for either organization to make basic assumptions for meeting each others' needs. For example, the semiconductor industry should not assume their technical employees are not interested in teaching part-time. Conversely, community colleges should not assume that skilled technical specialists from industry are aware of potential part-time teaching positions.

There are two ways in which community colleges can obtain part-time technical faculty: (a) on-demand, and (b) building a resource pool. A review of literature suggests that the majority of community colleges secure part-time instructors on demand, or as the need arises. This may be effective when part-time instructors are plentiful in a given discipline. However, regional interviews with community college partners and survey data suggest that it is much more difficult to locate and recruit qualified technical

specialists from the semiconductor industry. Data from this study suggest that building a resource pool of qualified part-time faculty may be an effective tool in planning for current and future faculty needs.

Greater awareness of available teaching positions should come through aggressive recruitment. However, success of technical specialists accepting a part-time teaching position is far from guaranteed. Administrators and experienced instructors should also be aware of the possible influences that self-efficacy may have on potential instructors.

5.4 Self-Efficacy

5.4.1 Discussion

Along with faulty assumptions about interest and awareness, recruiters often overlook candidate perceptions of their motivation and teaching ability. Understanding self-efficacy is an important link to recruitment as it enables one to better understand how perceptions of motivation and ability affect the decision to teach. Such influences normally occur before accepting a teaching position and may influence the decision to teach part-time and the ability to teach effectively. For example, after technical specialists have gained experience on the job, do they perceive themselves as possible candidates for teaching their skills to others? Do they want to teach part-time at a community college? Can they assume the role of instructor? How does self-efficacy, or their belief about their ability to teach, influence such decisions? Answers to these questions are helpful to community colleges as they strive to increase their pool of qualified technical instructors. A review of literature and survey data suggest that self-efficacy can increase when candidates for part-time teaching positions receive assistance with faculty development and/or mentor programs.

As a group, respondents were highly confident about their professional abilities and potential teaching abilities. There is no evidence from this survey to indicate that self-efficacy is a barrier to part-time teaching for technical specialists.

An important characteristic element surfaced, however, as a sizable majority of respondents (75%) indicated that they had previous experience in teaching or training others. Coupled with the general perception of their confidence on the job (82% indicating *very confident* to *completely confident*) and levels of confidence in their teaching ability with assistance (79% indicating *very confident* to *completely confident*), it appears that many community colleges can be optimistic about locating qualified people for their part-time pool of technical instructors. However, other variables such as lack of awareness of teaching positions (83%), insufficient time (51%), too many other commitments (41%), and intensive work load (33%), indicate that there will still be challenges to overcome.

5.4.2 Conclusions

Even though Brown, Brooks, and Associates (1990) indicated that few published studies were available that address the effects of interventions designed to increase self-efficacy beliefs relating to occupational behavior, Bandura (1977) suggested social learning determinants of self-efficacy can be varied systematically and their effects measured. Hence, propositions concerning the origins of self-efficacy are verifiable with some precision and can be applied to research topics such as this. This study suggests two conclusions about self-efficacy as technical specialists consider teaching:

1. Self-efficacy is one of several possible barriers in making the decision to teach or not to teach.

2. Offering and implementing assistance in teaching proficiency increases the perception by technical specialists that they can be successful in teaching. This can be either a program of faculty development in education and/or a mentoring program of assistance. The results of this study, however, suggest that self-efficacy is less of a barrier than originally anticipated.

5.4.3 Implications

Since respondents were generally very efficacious and optimistic about their ability to teach, community colleges should develop imaginative ways to determine their interest in teaching as well as being able to demonstrate teaching skills. For example, candidates could accomplish this by demonstrating or presenting videotapes of their teaching ability. Once technical specialists accept a part-time teaching position, community colleges should then focus their efforts on building and supporting teaching skills.

It is also important that new part-time faculty members remain enthusiastic and committed to their teaching assignment. The inclusion of a collegial, or connective approach to faculty development is an important, but often neglected part of the recruitment and hiring process. Well-designed faculty development programs should include an introduction to the campus culture as it enables new instructors to help become better integrated with the community college.

5.5 Faculty Development

5.5.1 Discussion

The investigation of faculty development focused on its suggested influence on self-efficacy as survey participants considered teaching part-time. It was important to receive input from survey participants as to whether their decision to teach part-time might be influenced by the knowledge that such opportunities may exist.

The next stage of research, therefore, probed the possible impact that the perceptions of faculty development might have in the decision to teach part-time. When asked about their confidence level about their teaching ability *without* assistance, only 34% responded *very confident* to *completely confident*. In contrast, when asked about their confidence level about their teaching ability *with* assistance, 79% responded *very confident* to *completely confident*. Furthermore, more than half of all respondents (52%) indicated they would be willing to participate in programs to help develop their teaching skills. Almost as many (51%) would be willing to work with a mentor to help develop their teaching skills.

Respondents were then asked how they would rank the importance of using specific educational tools. As expected, the majority of respondents (76%) felt that *content knowledge* was the most important tool necessary in teaching students, while 55% felt that it was important to know how to *teach effectively*. At the other end of the spectrum of importance, only 11% felt it was necessary to *advise students out of class*, followed by *orientation to teaching adults* at 13%. This data suggests part-time technical instructors recruited from industry may make inappropriate assumptions about the nature of teaching adults. Respondents were not possibly aware of the connection between *how to teach effectively* and *orientation to teaching adults*, but a clear relationship exists for further exploration.

5.5.2 Conclusions

Although a review of literature reflects little in faculty development strategies for new part-time technical instructors, survey data suggest that faculty development plays an important role in the recruitment process. When instructor applicants anticipate faculty development assistance from community colleges, it is likely applicants will be more effective instructors than without such assistance. Beginning teacher assistance programs must suit the needs of the new instructors in order to be effective. There should be a broad-based support program for new part-time instructors. A successful teacher induction program should be reactive to the needs of new instructors and reflective of positive educational strategies.

5.5.3 Implications

Without clear goals for recruitment and faculty development for new part-time hires, effective instruction may be compromised. Technical specialists who accept the challenge of part-time teaching do so in anticipation of a rewarding experience. They will have a positive experience as instructors when a predetermined program of faculty development helps build educational skills and a sense of collegial acceptance by full-time faculty and administrators. By so doing, there should be a higher rate of retention of technical instructors. These instructors should then become a positive link between community colleges and industry as they produce qualified graduates from technical programs.

5.6 Observations

The desired outcome of this study is to improve communication and cooperation between industry and educators. As educational institutions and industry become more aware of the barriers that may prevent technical specialists from becoming part-time instructors, they should be able to implement strategies to overcome these barriers. Community colleges should then increase the pool of qualified technical part-time faculty, resulting in an increase of qualified operators and technicians for industry. After sharing results with the participating companies, SEH America and Sharp Microelectronics, generalized results will be shared with the academic community.

Although this study explored the barriers to teaching of technical specialists at only one test site, it is likely that other semiconductor manufacturers face similar dilemmas of staffing throughout this industry. Other specialized industries that face similar staffing challenges may find this study of interest as well. It is important to note, however, this study was explorative and descriptive and no inferential or predictive generalizations should be made.

5.7 Recommendations for Change

As community colleges seek to fill the increasing demand for part-time technical instructors, industry seeks to increase their ranks of technical employees. Clearly, the two should communicate more effectively with each other. Ineffective communication and traditional recruitment practices help create a serious shortage of part-time technical instructors for the semiconductor industry. The shortage of instructors contributes to the shortage of qualified technical workers. Several changes should take place to establish sufficient part-time technical instructors:

1. Changes in communication. When community colleges recruit potential technical instructors, communication is generally not very effective with industrial partners. For more effective communication, community colleges should:

- a. Select a recruitment representative who is familiar with the needs of industry, preferably one who has related experience in the field.
- b. Establish a foundation of trust with industrial contacts, or partner corporations. Get to know these contacts and their educational needs. Without trust, corporations may perceive recruitment efforts as intrusive and threatening.
- c. Locate community college advocates within partner corporations. Advocates can help increase the technical instructor pool with their knowledge of qualified potential instructors. As the number of instructors increase, the number of student graduates usually increase. It is therefore possible for advocates to help increase the number of skilled workers for their companies. It may be also possible for a company employee to serve the same role as liaison and advocate for both company and community college. This gives each partner transparent and accurate views of educational needs and services. The corporate partner may pay all or part of the salary.

2. Recruitment practices.

- a. Community colleges should be more proactive in recruiting technical instructors. Passive recruitment, such as posting job announcements with corporate partners and classified newspaper advertisements, is generally insufficient. Personal involvement with corporate partners and potential instructors is a more effective way to locate and hire technical instructors. Time taken to locate a new teaching resource is likely to justify the added expense.
- b. Consider some kind of incentive for recruitment efforts for the community

college. Be aware, however, that corporate advocates are still corporate employees. Do not infringe on their company time without company permission to do so. Incentives may be monetary, or they may be more broadly based to meet company needs. Offer to reimburse time spent on recruitment efforts or offer a workshop on teaching techniques for company instructors. Not only will a workshop help strengthen their instructors it may also identify potential community college instructors at the same time.

3. Faculty development. Re-examine the old paradigm of limited access to faculty development programs by full-time instructors. Since part-time faculty typically represent the majority of the instructional staff, it appears necessary to strengthen instructional pedagogy through faculty development programs. If educators and industry are to succeed in their mutually beneficial roles, community colleges should:

- a. Include a discussion of faculty development in the recruitment process. Results from this study clearly suggest that the perception of faculty development influences the decision to teach by potential instructors. The results of this discussion should yield a greater number of potential applicants for the pool of technical instructors.
- b. Implement a systemic and continuing program of faculty development for part-time instructors, including potential, beginning, intermediate, and experienced instructors.
- c. Share the expense of faculty development with corporate partners and consider paying instructors for their time at inservice sessions. Development programs are investments that strengthen technical programs through trusted educational partnerships and improved student learning. Corporate partners that recognize the need for a qualified workforce are likely to participate in such collaborations.

Although corporate partners may be protective about community colleges taking valuable time away from their employees if they teach part-time, an alternative would be to reexamine the use of part-time instructors. From a company's perception, perhaps it is more practical to provide support for one full-time instructor instead of two or three part-time instructors. Depending upon the urgency of an increased workforce, some corporate partners may be willing to lend a specialist to a community college in exchange for accelerating certificated graduates. To avoid possible salary inequity with other instructors, community colleges may elect to have corporate partners continue to retain highly paid specialists on the company payroll.

An alternative could be the planning and implementation of corporate apprenticeship programs similar to those found in Europe. Community colleges could work closely with corporate partners in customizing such programs. After the completion of instructional development workshops, corporations may elect to use their own staff to teach students while on the job.

5.8 Recommendations for Further Study

This explorative study has added to the foundation of knowledge as it identified barriers to recruitment of part-technical instructors. To add to further understanding of this work, this researcher suggests using additional test sites within the semiconductor industry. As researchers secure multiple semiconductor test sites, it will be possible to build a structure of generalizable data. Further, researchers should meet with community college partners of semiconductor manufacturers to validate the shortage of technical instructors and the difficulty in recruiting part-time technical faculty.

Since perceptions of confidence were generally high and awareness of teaching possibilities low, future theoretical frameworks should build on theories of marketing or

recruitment. Faculty development is also of interest, but can be more adequately addressed with part-time instructors currently employed in this capacity.

There is also concern about some respondents indicating that they had insufficient time to teach part-time. Although this study did not probe into *why* they did not have enough time, it is possible that some used *lack of time* as a rationalization not to teach. Additional research in this area would help clarify this question.

With reductions in budgets, researchers should also explore how community colleges can locate and implement additional funding resources. For example, corporate partners may be willing to match educational funds from their training and development budget. New funding resources may also be available by extending corporate partners to include high-tech subcontractors, or primary manufacturers that integrate semiconductors into their product lines. Research into these areas may prove very productive.

5.9 Closing Statement

Of all the issues related to staffing technical faculty, the most crucial barrier that influences the decision of technical specialists to teach is ineffective communication between the community college and potential instructor. The vast increase in knowledge and extensive use of technology strongly suggest that community colleges and industry should communicate more effectively. If community colleges are to increase their pool of part-time technical faculty, technical specialists need to be aware that part-time teaching positions are available. If industry is to fill its growing need for qualified technical specialists, it should be willing to share the talent of its best employees with the community.

While many respondents lacked sufficient time to become part-time instructors, the results of this study suggest many others were willing to explore the possibility of part-

time teaching. Internal, or self-perceived, barriers do not prevent over half of the respondents from expressing an interest in teaching part-time. Most are confident about their professional abilities as well as their teaching abilities.

The primary barriers to teaching appear to be external, beyond the control of those who qualify for such positions. Passive recruiting methods by community colleges and employers reluctant to seek long-term staffing solutions continue to be major barriers in finding and keeping effective part-time technical instructors. Successful recruitment and retention of part-time instructors depend on proactive commitment by both institutions. This commitment will ultimately fill the needs of both institutions when both become actively involved in recruiting part-time instructors. Cooperative dialogues must emerge, and they must also produce results. Community colleges can realize their goal of meeting the needs of the community, and industry can increase its qualified technical staff for greater profitability.

Bibliography

- Agne, K. (1992). Caring: The expert teacher's edge. Educational Horizons, 70(3). 120-124.
- Allen, S. C., (1995, November 6). Help wanted in high tech. Corvallis (OR) Gazette-Times, pp. C1-C2.
- American Association of Community Colleges (1960, 1975, 1981, 1986, 1991, 1993). Annual fall survey. Washington, DC: Author.
- Angel, D. P. (1989). The labor market for engineers in the U.S. semiconductor industry. Economic Geography, 65(2), 99-112.
- Angel, D. P. (1990). New firm formation in the semiconductor industry: Elements of a flexible manufacturing system. Regional Studies, 24(3), 211-221.
- Angel, D. P. (1994). Restructuring for innovation: The remaking of the U.S. semiconductor industry. New York: Guilford Press.
- Ashworth, T. E. (1988). Improving the effectiveness of part-time faculty in community colleges. Community Services Catalyst, 18(3), 15-18.
- Baker, G. A., III, Roueche, J. E., & Gillett-Karam, R. (1990). Teaching as leading: A theme for a new decade. Community, Technical, and Junior College Journal, 60(5), 26-31.
- Bandura, A. (1977). Self-efficacy: Toward a unifying theory of behavioral change. Psychological Review, 84(2), 191-215.
- Bandura, A. (1982). Self-efficacy mechanism in human agency. American Psychologist, 37(2), 122-147.
- Barnett, J. (1995a, October 1). Oregon lures chip makers in a factory-building boom that's bringing sunshine to the state's economic skies. Portland (OR) The Oregonian, E1, E10.
- Barnett, J. (1995b, November 5). Glow on chips casts bright gleam of golden age. Portland, OR: The Oregonian, D1, D6.
- Bartow, D. S. (1990). Part-time faculty: An untapped resource. (Report No. JC910033). Scottsdale, AZ: Proceedings of the National Conference on Professional Development of Part-Time Occupational/Technical Faculty. (ERIC Document Reproduction Service No. ED 326 294).
- Basta, N. (1989). Top professions: The 100 most popular, dynamic, and profitable careers in America today. Princeton, NJ: Peterson's Guide.
- Bender, L. W. & Breuder, R. L. (1973). Part-time teachers: 'Step children' of the community college. Community College Review, 1(1). 29-37.

- Bergeron, L. M. & Romano, J. L. (1994). The relationships among career decision-making self-efficacy, educational indecision, vocational indecision and gender. Journal of College Student Development, 35(1), 19-24.
- Betz, N. E. (1994). Self-concept theory in career development and counseling. Career Development Quarterly, 43(1), 32-40.
- Betz, N. E. & Hackett, G. (1986). Applications of self-efficacy theory to understanding career choice behavior. Journal of Social and Clinical Psychology, 4(3), 279-289.
- Betz, N. E. & Hackett, G. (1987). Concept of agency in educational and career development. Journal of Counseling Psychology, 34(3), 299-308.
- Biles, G. E., & Tuckman, H. P. (1986). Part-time faculty personnel management policies. New York: American Education Council on Education/Macmillan.
- Bishara, M. N., King, C. R., & Lotito, T. Jr. (1989). Part-time faculty in technology: Special need, special responses. (Report No. JC910033). Scottsdale, AZ: Proceedings of the National Conference on Professional Development of Part-Time Occupational/Technical Faculty. (ERIC Document Reproduction Service No. ED 326 294).
- Blai, B. (1976). Employer-based evaluations of occupational education programs. Community College Review, 3(4), 70-75.
- Blair-Larsen, S. M. & Bercik, J. T. (1992). A Collaborative model for teacher induction. Education, 113(1), 25-31.
- Bores-Rangel, E., Church, A. T., Szendre, D. & Reeves, C. (1990). Self-efficacy in relation to occupational consideration and academic performance in high school equivalency students. Journal of Counseling Psychology, 37(4), 407-418.
- Borg, W. A., Gall, J. P., & Gall, M. D. (1993). Applying educational research: A practical guide (3rd ed.). New York: Longman.
- Bragg, D. B., Hamm, R. E., & Trinkle, K. A. (1995). Workbased learning in two-year colleges in the United States. National Center for Research in Vocational Education. Berkeley, CA: Author.
- Brown, G. C. (1982). Part-time faculty effectiveness: Fulfilling the need. Paper presented at the National Policy Conference on Urban Community Colleges. (Report No. JC820244). Detroit, MI: Author. (ERIC Document Reproduction Service No. ED (216 741).
- Brown, D. & Brooks, L. (1990). Career choice and development (2nd ed.). San Francisco: Jossey-Bass.
- Burton, L. & Celebuski, C. A. (1995). Technical education in 2-year colleges. HES Survey 17. Washington, DC: National Science Foundation, Division of Science Resources Studies.
- Cain, B. (1996, October 16). State jobless rate dives. Albany, OR: Albany Democrat-Herald, A1.

- California Community Colleges Academic Senate (1989). Equivalence to the minimum qualifications. (Report No. JC900129). Sacramento, CA: Author. (ERIC Document Reproduction Service No. ED 315 139).
- Carnevale, A. P. & Schulz, E. R. (1989, July 24). Best practices: What works in training and development. Alexandria, VA: American Society for Training and Development.
- Carter, D. J. (1994). The status of faculty in community colleges: What do we know? New Directions for Community Colleges, 22(3), 3-18.
- Carter, S. (1995, August 13). Schools on the bleeding edge: Schools play the game of high-tech catch-up. Portland, OR. The Oregonian, A1, A12.
- Chatman, S. & Jung, L. (1992). Concern about forecasts of national faculty shortages and the importance of local studies. Research in Higher Education, 33(1), 31-57.
- Clark, B. A. (1990). Comparison of the achievement of students taught by full-time versus adjunct faculty in the chemistry of hazardous materials course: Governance and management. Ed.D. Practicum. (Report No. HE024348). Maryland: Nova University. (ERIC Document Reproduction Service No. ED 330 261).
- Cline, L. (1993). Work to school transition. Part-time faculty bring expertise, challenges to college. Vocational Education Journal, 68(2), 26-27, 49.
- Cohen, A. M. (1969). Dateline '79: Heretical concepts for the community college. Beverly Hills, CA: Glencoe Press.
- Cohen, A. M. & Brawer, F. B. (1977). The two-year college instructor today. New York: Praeger.
- Cohen, A. M. & Brawer, F. B. (1996). The American community college (3rd ed.). San Francisco: Jossey-Bass.
- Commission on the Future of Community Colleges (1988). Building communities: A vision of a new century. Washington, DC: American Association of Community Colleges.
- Conerly, W. (1995). The high-tech boom - why is Portland the winner? The McGregor Millette Report, 8(2). p.1
- Crockett, R. O. (1995, January 27). State employers find it necessary to boost training. Portland, OR: The Oregonian, B1-B2.
- Crockett, R. O. (1995, August 6). Blue collared: The high-tech influx may deepen the divide between rich and poor. Portland (OR) The Oregonian, A1, A14.
- Cruise, R. J., Furst, L. G., & Klimes, R. E. (1980). A comparison of full-time and part-time instructors at midwestern community colleges. Community College Review, 8(1), 52-56.
- DeSantis, J. P. (1980). Support for training vocational-technical adjunct faculty. New Directions for Community Colleges, 8(2), 67-71.

- Donaldson, J. F., Flannery, D., & Ross-Gordon, J. (1993). A triangulated study comparing adult college students' perceptions of effective teaching with those of traditional students. Continuing Higher Education Review, 57(3), 147-165.
- Dun & Bradstreet (1996). The Career Guide, 1996: Dun's Employment Opportunities Directories. New York: Author.
- Dunlap, D. M. (1986). The coming teacher shortage: What schools can do about it. Eugene, OR: Oregon School Study Council. (ERIC Document Reproduction Service No. ED 267 516).
- Eells, W. C. (1931). The junior college. Boston: Houghton Mifflin.
- Eliason, N. C. (1980). Part-time faculty: A national perspective. New Directions in Community Colleges, 14(1), 1-12.
- Engleberg, I. N. (1993). The emerging professoriate in community colleges. (Report No. CS508531). Miami Beach, FL: Speech Communication Association. (ERIC Document Reproduction Service No. ED 368 020).
- Evans, R. N. (1988). The History of NAITTE. Champaign, IL: National Association of Industrial and Technical Teacher Educators.
- Feldman, K. A. (1988). Effective college teaching from the students' and faculty's view: Matched or mismatched priorities. Research in Higher Education, 28(4), 291-344.
- Ferrell, C. M., & Daniel, L. G. (1993). Construct validation of an instrument measuring teacher career motivations. Paper presented at the annual meeting of the Mid-South Educational Research Association, New Orleans, LA. (ERIC Document Reproduction Service No. ED 365 719).
- Field, S. (1992). 100 best careers for the year 2000. New York: Prentice Hall.
- Findley, B. F. (1995). Teaching excellence: A reflective paradigm. Community College Journal, 65(4), 26-29.
- Fowler, F. J., Jr. (1993). Survey research methods (2nd ed.). Newbury Park, CA: Sage.
- Francis, M. (1995, July 23). A tale of two hearts, not beating as one. Portland, OR: The Oregonian, pp. 2M, 10M.
- Franklin, P., Laurence, D., & Denham, R. D. (1988). When solutions become problems: Taking a stand on part-time employment. Academe, 74(3), 15-19.
- Friedlander, J. (1980). Instructional practices of part-time faculty. New Directions for Community Colleges, 8(2), 27-36.
- Galbraith, M. W. (1989). Essential skills for the facilitator of adult learning. Lifelong Learning, 12(6), 10-13.
- Galbraith, M. W., & Shedd, P. E. (1990). Building skills and proficiencies of the community college instructor of adult learners. Community College Review, 18(2), 6-14.

- Gappa, J. M. & Leslie, D. W. (1993). The invisible faculty: Improving the status of part-timers in higher education. San Francisco: Jossey-Bass.
- Gianini, P. & Sarantos, S. (1995). Academic rhetoric versus business reality. In J. E. Roueche, L. S. Taber, and S. D. Roueche (Eds.), The company we keep: Collaboration in the American community college. Washington, DC: Community College Press.
- Gleazer, E. J. Jr. (1968). This is the community college. New York: Houghton Mifflin
- Gonzalez, C. (1995, July 9). Suit yourself. Portland, OR: The Oregonian, F1, F12.
- Grote, J. R. (1977). Current trends and definitions in occupational education. Community College Review, 4(3), 50-56.
- Grymes, J. R., Jr. (1976). A survey and analysis of part-time instructors at J. Sargeant Reynolds community college. Richmond, VA: J. Sargeant Reynolds Community College. (ERIC Document Reproduction Service No. ED 125 687).
- Guthrie-Morse, B. & Julian, C. A. (1989). The small college's tool for effectiveness: Telecommunications. Community, Technical, and Junior College Journal, 60(2), 42-45.
- Hackett, G., & Betz, N. E. (1981). A self-efficacy approach to the career development of women. Journal of Vocational Behavior, 18(3), 326-339.
- Hackett, G. Betz, N. E., O'Halloran, M. S., & Romac, D. S. (1990). Effects of verbal and mathematics task performance on task and career self-efficacy and interest. Journal of Counseling Psychology, 37(2), 169-177.
- Harris, D. A. (1980). From the president's perspective: Part-time faculty in the 1980s. New Directions for Community Colleges, 8(2), 13-17.
- Harris, D. A., & Parsons, M. H. (1975). Adjunct faculty: A working system of development. Hagerstown Junior College. (ERIC Document Reproduction Service No. ED 115 318).
- Hartleb, D. & Vilter, W. (1986). Part-time faculty, full-time problems. New Directions for Community Colleges, 14(1), 15-22.
- Hawkins, B. D. (1993, July 5). Sharp pro and con division on merits of part-time faculty. Community College Week, pp. 8-9.
- Hernandez, R. (1995, October 1). Higher ed takes back seat as high-tech incentive. Portland, OR: The Oregonian, E1, E10.
- Higgins, C. S., Hawthorne, E. M., Cape, J. A., & Bell, L. (1994). The successful community college instructor: A profile for recruitment. Community College Review, 21(4), 27-36.
- Holifield, M., Bradley, M. J., Strickland, H., & Carroll, F. (1994). Recruiting future teachers via summer academies. Education, 114(3), 343-346.

- Holland, J. L., & Holland, J. E. (1977). Vocational indecision: More evidence and speculation. Journal of Counseling Psychology, 24(5), 404-414.
- Jackofsky, E. F. & Peters, L. H. (1987). Part-time versus full-time employment status difference: A replication and extension. Journal of Occupational Behavior, 8, 1-9.
- Jelinek, M., & Schoonhoven, C. (1992). The Innovation Marathon: Lessons from High Technology Firms. Oxford, UK: Blackwell Press.
- Joseph, P. B. & Green, N. (1986). Perspective on reasons for becoming teachers. Journal of Teacher Education. 37(6). 28-33.
- Kantor, S. L. (1991). Direct services to business in Colorado community colleges. [CD-ROM]. Abstract from: ProQuest File: Dissertation Abstracts Item: AAC 9204996.
- Kaufman, S. (1996, January 7). Semiconductor field still shows strength. Portland, OR: The Oregonian, F12.
- Kekke, R. (1983). Who's Mr. Staff: Cheap labor or valued resource? (Report No. JC840589). Iowa: Paper presented at the Conference of the Central States Speech Association. (ERIC Document Reproduction Service No. ED 251 134).
- Kidd, J. (1995, May 21). Labor Drain: Eugene may have trouble filling a proposed Hyundai plant with skilled workers. Albany (OR) The Register Guard, pp. 1A, 8A.
- Knox, A. (1987). Helping adults learn. San Francisco, CA: Jossey-Bass.
- Kuhns, E. P. (1971). Part-time faculty. In W. K. Ogilvie, & M. R. Raines, (Eds.), Perspectives on the community-junior college: Selected Readings (pp. 466-473). New York: Appleton-Century-Crofts.
- Langford, A. G. (1981). Competing with industry for faculty members. (Report No. JC810541). Charleston, SC: Paper presented at the conference of the Association of Community College Trustees. (ERIC Document Reproduction Service No. ED 206 370).
- Lankard, B. A. (1993). Part-time faculty in adult and vocational education. (Report No. CEO65124). Washington, DC: Office of Educational Research and Improvement. (ERIC Document Reproduction Service No. ED 363 797).
- Lent, R. W., Brown, S. D. & Hackett, G. (1994). Toward a unifying social cognitive theory of career and academic interest, choice, and performance [Monograph]. Journal of Vocational Behavior, 45(1), 79-122.
- Leslie, D. W. (1989). Creative staffing: Problems and opportunities. New Directions for Institutional Research, 16(3), 33-44.
- Leslie, D. W., Kellams, S., & Gunne, G. (1982). Part-time faculty in American higher education. New York: Praeger.
- Li, Y. (1995, September). Migration possibility & retirement. AACC Letter, 401. Washington, DC: American Association of Community Colleges.

- Lombardi, J. (1975). Part-time faculty in community colleges. Topical paper No. 54. Los Angeles: ERIC Clearinghouse for Junior Colleges. (ERIC Document Reproduction Service No. ED 115 316).
- London, H. B. (1989). In between: the community college teachers. In J.L. Ratcliff (Ed.), ASHE Reader on Community Colleges (pp. 247-253). Needham Heights, MA: Ginn.
- Lortie, D. C. (1975). School teacher: A sociological study. Chicago: University Press.
- Lundy, K. L. & Warne, B. D. (1989). Part-time faculty: Student perceptions and experiences. Canadian Journal of Higher Education, 19(2), 73-85.
- Luzzo, D. A. (1993a). Reliability and validity testing of the career decision-making self-efficacy scale. Measurement and Evaluation in Counseling and Development, 26(2), 137-142.
- Luzzo, D. A. (1993b). Value of career-decision-making self-efficacy in predicting career-decision-making attitudes and skills. Journal of Counseling Psychology, 40(2), 194-199.
- Mager, R. F. (1992). No self-efficacy, no performance. Training, 29(4), 32-35.
- Marsh, J. P. & Lamb, T. (Eds.). (1975). An introduction to part-time teaching situations with particular emphasis on its impact at Napa Community College. Unpublished paper. (ERIC Document Reproduction Service No. ED 125 683).
- Maurer, S. D., Howe, V., & Lee, T. W. (1992). Organizational recruiting as marketing management: An interdisciplinary study of engineering graduates. Personnel Psychology, 45(4), 807-833.
- Mayville, Z. (1989). Emerging trends in higher education. Office of Educational Research and Improvement. (Report No. HE023309). Washington DC: Author. (ERIC Document Reproduction Service No. ED 317 109).
- McCall, W. (1995, July 19). State's 'silicon forest' gets dense. Albany, OR: Democrat-Herald, p. A5.
- McGregor, Millette & Associates (1995). The high-tech boom - Why is Portland the winner? McGregor Millette Report, pp. 1-2.
- McGuire, J. (1993). Part-time faculty: Partners in excellence. (Report No. JC940202). Battle Creek, MI: League for Innovation in the Community College, Kellogg Foundation. (ERIC Document Reproduction Service No. ED 367 429).
- McLaughlin, A., Bennett, W., & Verity, C. (1988). Building a quality workforce. Washington, DC: U.S. Government Printing Office.
- Miller, B. W. (1979). Higher education and the community college. Washington, DC: University Press of America.

- Miller, D. S. (1992). The impact of the preponderance of part-time faculty on the mission of the community college (faculty). [CD-ROM]. Abstract from: ProQuest File: Dissertation Abstracts Item: AAC 9223568
- Miller, J. (1983). Part-time teachers in adult and vocational education. (Contract No. NIE-C-400-81-0035). Washington, DC: National Institute of Education. (Report No. CE800092). California. Opinion Paper. Author. (ERIC Document Reproduction Service No. ED 240 400).
- Miller, R. J. (1987). The impact of part-time faculty on the learning environment. A review of selected literature with recommendations for future research. Journal of Continuing Higher Education, 35(2), 5-10.
- Multon, K. D., Brown, S. D., & Lent, R. W. (1991). Relation of self-efficacy beliefs to academic outcomes: A metaanalytic investigation. Journal of Counseling Psychology, 38(1), 30-38.
- Munsey, W. R. C. (1986). Part-time faculty: The value of the resource. New Directions for Community Colleges, 14(1) 7-13.
- Murray, M. L. (1994). What's the plan? Vocational Education Journal. 69(2). 24-25, 56.
- National Center for Education Statistics (1988). Profiles of faculty in higher education institutions, 1988: Statistical Analysis Report (NSOPF-88). (NCES Publication No. NCES91-389). Washington DC: U.S. Government Printing Office.
- National Center for Education Statistics (1992). Integrated postsecondary education data system glossary. (NCES Publication No. NCES92-081). Washington DC: U.S. Government Printing Office.
- Nevill, D. D. & Schlecker, D. I. (1988). The relation of self-efficacy and assertiveness to willingness to engage in traditional/nontraditional career activities. Psychology of Women Quarterly, 12(1), 91-98.
- O'Banion, T., & Associates (1994). Teaching and learning in the community college. Washington, DC: Community College Press.
- Opp, R. D., & Smith, A. B. (1994). Effective strategies for enhancing minority faculty recruitment and retention. New Directions for Community Colleges, 22(3). 43-55.
- Oregon Career Information System (1995). Oregon occupations, 1995-1996. Eugene, OR: Author.
- Oser, F., Dick, A., and Party, J. (1992). Effective and responsible teaching. San Francisco: Jossey-Bass
- Osipow, S. H., Carney, C. G., & Barak, A. (1976). A scale of educational and vocational undecidedness: A typological approach. Journal of Vocational Behavior, 9, 233-243.
- Palmer, J. (1986). Sources and information: Decision making in hard economic times. New Directions for Community Colleges, 14(1), 101-112.

- Parsons, M. H. (1980). Future directions: Eight steps to parity for part-time faculty. New Directions for Community Colleges, 8(2), 85-88.
- Parsons, M. H. (1992). Quo Vadis: Staffing the people's college 2000. New Directions for Community Colleges, 20(3), 3-10.
- Peterson, S. L. (1993). Career decision-making self-efficacy and institutional integration of underprepared college students. Research in Higher Education, 34(6), 659-685.
- Prickel, D. O. (1994). The development and validation of a writing self-efficacy scale for adult basic writers and its use in correlational analysis. Unpublished doctoral dissertation, Oregon State University, Corvallis.
- Prosser, C. A. & Allen, C. R. (1925). Vocational education in a democracy. New York: The Century Co.
- Prosser, C. A. & Quigley, T. H. (1950). Vocational education in a democracy (rev. ed.) Chicago: American Technical Society.
- Reed, J. L. (1967). The recruitment and training of vocational teachers. In V. H. Robertson (Ed.) Guidelines for the seventies, 1967 yearbook, trade and industrial division, American Vocational Association. Chicago: American Technical Society.
- Reis, R. A. (1993). Becoming an electronics technician: Securing your high-tech future. New York: Macmillan.
- Rice, E. (1982). Training instructors to provide related instruction: Issues and implementation. Washington, D.C.: Conserva, Inc. and U.S. Department of Education.
- Rigden, D. (1994). Quid pro quo: Educators take the lead. Vocational Education Journal, 69(5), pp. 22-23, 39.
- Roberts, R. W. (1965). Vocational and practical arts education: History, development, and principles. (2nd ed.). New York: Harper and Row.
- Rose, S. M. (1992). The use of adjunct faculty in the community college: A grounded theory analysis (faculty). [CD-ROM]. Abstract from: ProQuest File: Dissertation Abstracts Item: AAC 9320790.
- Ross, J. A. (1994). Beliefs that make a difference: The origins and impacts of teacher efficacy. Paper presented at the annual meeting of the Canadian Association for Curriculum Studies, Calgary, Alberta, Canada. (ERIC Document Reproduction Service No. ED 379 216).
- Rothwell, W. J., & Sredl, H. J. (1992). The ASTD reference guide to professional human resource development roles and competencies (3rd ed. Vol. 2). Amherst, MA: HRD Press.
- Roueche, J. E., Roueche, S. D., & Milliron, M. D. (1995). Strangers in their own land: Part-time faculty in American community colleges. Washington, DC: American Association of Community Colleges.

- Saks, A. M., Wiesner, W. H., & Summers, R. J. (1994). Effects of job previews on self-selection and job choice. Journal of Vocational Behavior, 44(3), 297-316.
- Semiconductor Workforce Consortium. (1995). Building and strengthening the workforce: Semiconductor industry workforce and training assessment (phase one). Portland, OR: Author.
- Shafritz, J. M., Koeppe, R. P., & Soper, E. S. (1988). The facts on file dictionary of education. New York: Facts on File.
- Sharp Microelectronics Technology, Inc. (1995). The Sharp way to build a career: A company profile [Brochure]. Camas, WA: Author.
- Shin-Etsu SEH America (1995). Small Teams Doing Big Things: SEH America [Brochure]. Vancouver, WA: Author.
- Slaney, R. B., Palko-Nonemaker, D., & Alexander, R. (1981). An investigation of two measures of career indecision. Journal of Vocational Behavior, 18(1), 92-103.
- Smart, J. C. (1985). Higher education: Handbook of theory and research (Vol. 1). New York: Agathon Press.
- Smith, C. (Ed.). (1993). Advanced technology in the pacific northwest: Directory & guide, 1993. Boise, ID: Quanix Data Services.
- Spangler, M. S. (1990). Part-time faculty: Recognizing an unprotected minority. (Report No. JC900379). California. Opinion Paper. Author. (ERIC Document Reproduction Service No. ED 321 793).
- Spinetta, K. I. (1990). Part-time instructors in the California community colleges: A need to revise current policies. Community College Review, 18(1) 43-49.
- Standard & Poor's (1995). Standard & Poor's Industry Surveys. New York: Author.
- Stern, J. D. & Chandler, M. O. (Eds.). (1987). The condition of education: A statistical report. Washington, DC: National Center for Education Statistics, U.S. Department of Education.
- Stern, S. (1993). [Survey of northwest community college staffing and enrollment]. Unpublished raw data.
- Taylor, K. M. & Betz, N. E. (1983). Applications of self-efficacy theory to the understanding and treatment of career indecision. Journal of Vocational Behavior, 22(1), 63-81.
- Taylor, K. M. & Popma, H. P. (1990). An examination of the relationships among career decision-making self-efficacy, career salience, locus of control, and vocational indecision. Journal of Vocational Behavior, 37(1), 17-31.
- Thomas, K. (1996, Spring). High-tech finds a niche in the valley. Oregon's Willamette Valley Magazine, 1, 46-50.

- Thompson, H. (1984). Utilization of adjunct faculty members. (Report No. HE017472). Opinion Paper. Indiana: Indiana University at Kokomo. (ERIC Document Reproduction Service No. ED 247 824)
- Thornton, J. W. Jr. (1960). The community junior college. New York: John Wiley & Sons.
- Turgeon, M. L. (1983). Part time faculty: A comparative profile of characteristics and effectiveness at Corning Community College. (Report No. JC840120). New York: Ed.D. practicum, Nova University (ERIC Document Reproduction Service No. ED 244 654).
- U.S. Department of Education (1993). The condition of education, 1993. Washington, DC: National Center for Education Statistics.
- U.S. Department of Labor (1987). Workforce 2000: Work and workers for the 21st century. (USDOL Publication No. 0-186-705 QL3). Washington, DC: U.S. Government Printing Office.
- Vaughan, G. B. (1986). Part-time faculty: Nemesis or savior? New Directions for Community Colleges, 14(1), 23-30.
- Vaughan, G. B. (1995). The community college story: A tale of American innovation. Washington, DC: American Association of Community Colleges.
- Wallace, M. E. (1991). A one-time part-timer's response to the CCC statement of professional standards. College Composition and Communication, 42(3), 350-55.
- Wheeler, K. G. (1983). Comparisons of self-efficacy and expectancy models of occupational preferences for college males and females. Journal of Occupational Psychology, 56(1), 73-78.
- Williams, F. N. (1972). The neglected teachers: The part-time faculty. Adult Leadership, 21(3), 83-84.
- Woodberry, P. N. (1991). From novice to expert: Intentional changes of part-time instructors in a community college setting. [CD-ROM]. Abstract from: ProQuest File: Dissertation Abstracts Item: AAC 9221556

Appendix A

Survey Instrument

Survey of Technical Specialists in the Semiconductor Industry

Dear Semiconductor Professional:

The Semiconductor Workforce Consortium has reviewed this research and believes that your participation would be helpful in increasing the pool of qualified part-time faculty in community colleges for the semiconductor industry. To assure privacy, only aggregate results will be reported. In order to include your input in the survey results, your prompt response is necessary.

Instructions for Completion:

1. Please answer ALL questions. Estimates are okay.
2. Most questions ask for a circled response. Where appropriate, write in responses.
3. When you complete this survey, **please return it promptly to Bill Shelton, Human Resource Development Manager.**

**** Please Begin ****

1. Gender: (*circle one letter*) a. Male b. Female

2. Age on last birthday: _____ years

3. Race or ethnic origin: (*circle one letter*) d. Caucasian/White

a. African American/Black	e. Hispanic
b. American Indian or Alaskan Native	f. Pacific Islander
c. Asian	g. Other _____

4. What is the highest level of formal education you have completed?
 (*circle one letter and write in your area of specialization or major*)

a. Bachelor's degree, majoring in: _____	
b. Master's degree, majoring in: _____	
c. Doctoral degree, majoring in: _____	
d. Other: _____	

5. How long have you worked in the semiconductor industry?
_____ years _____ months
6. What is your area of specialization? (*circle the letter of your primary responsibility*)
- | | |
|---------------------------|-------------------------------|
| a. Design Engineer | e. Quality Assurance Engineer |
| b. Equipment Engineer | f. Test Engineer |
| c. Manufacturing Engineer | g. Other: _____ |
| d. Process Engineer | |
7. How long have you worked at this position?
_____ years _____ months
8. How many hours do you work on a typical shift?
_____ hours.
9. How many days per week do you normally work?
_____ days.
10. Do you work in a management capacity?
_____ yes _____ no
11. Have you ever been involved in teaching or training professional skills to others before, either formally or informally?
_____ yes _____ no
12. If yes to #11, where did you teach? (*circle those letters that apply*)
- | | |
|--------------|--------------------------|
| a. at work | |
| b. at school | c. other (specify) _____ |
13. How confident are you about your ability to perform your work on the job?
(*circle one letter*)
- | | |
|-------------------------|-------------------------|
| a. Very confident | |
| b. Reasonably confident | |
| c. Unsure | |
| d. Somewhat confident | e. Not at all confident |

14. My perceived level of success (performance mastery) at my job in the semiconductor industry is best described as: *(circle one letter)*
- a. High
 - b. Moderately high
 - c. Average
 - d. Below Average
 - e. Poor
15. Have you ever considered teaching your professional skills to others within the scope of your semiconductor employment as an “in-house” instructor?
- _____ yes _____ no
16. Have you ever considered teaching your professional skills to others at a community college?
- _____ yes _____ no
17. In what capacity(ies) would you be willing to help the semiconductor industry increase the pool of part-time technical instructors? *(circle the letters that apply)*
- a. Guest lecturer for at least one class session at a community college
 - b. Guest lecturer for at least one class session within your company
 - c. Part-time instructor, teaching at least one class per term at a community college
 - d. Part-time instructor, teaching at least one class per term within your company
 - e. Course development
 - f. Screening committee for instructor applicants
 - g. Other (specify) _____
 - h. None of the above
18. Are you aware that some community colleges offer part-time teaching positions in certain semiconductor categories?
- _____ yes _____ no
19. If “yes” to question #18, how did you first learn about the availability of part-time teaching at a community college? *(circle one letter)*
- a. By serving on a community college advisory committee

- b. Checked at local community college for part-time teaching positions
- c. College or university career planning/placement center
- d. Contact from a community college teacher or administrator inviting you to teach a class
- e. Co-worker teaches part-time at a community college
- f. Family or relative teaches at a community college
- g. Had part-time teacher(s) when I attended a community college technical program
- h. Job announcement/newsletter from community college listing part-time position
If so, where did you see this job announcement? _____
- i. Joint apprenticeship training committee
- j. Newspaper
- k. Posting at your regular job (internal memo from your full-time employer)
- l. Recruiter from the community college interviewing potential part-time faculty at your full-time workplace
- m. Referral by someone at your other employment
- n. Referral by someone already working part-time at a community college
- o. Other: _____

20. Assume you were asked to teach part-time. Without assistance, how confident are you about your ability to teach in your area of expertise? (*circle one letter*)

- a. Very confident
- b. Reasonably confident
- c. Unsure
- d. Somewhat confident
- e. Not at all confident

21. Assume that someone could train you to become an effective instructor. What level of confidence would describe your perceived ability to teach? (*circle one letter*)

- a. Very confident
- b. Reasonably confident
- c. Unsure
- d. Somewhat confident
- e. Not at all confident

22. Would you be willing to participate in programs to help develop your teaching skills?

_____ yes _____ no _____ not certain

23. Would you be willing to work with a mentor to help develop your teaching skills?

_____ yes _____ no _____ not certain

24. How important would you rate each of the following if they could help you increase confidence as an effective part-time technical instructor?

(circle the letters that apply: V, M, S, N, or D)

	Very Important	Moderately Important	Somewhat Important	Not Important	Don't Know
a. Knowledge of course content	V	M	S	N	D
b. How to teach effectively	V	M	S	N	D
c. Knowledge/skills updating	V	M	S	N	D
d. Lesson planning	V	M	S	N	D
e. Orientation to teaching adults	V	M	S	N	D
f. Resources for help	V	M	S	N	D
g. Advising students out of class	V	M	S	N	D
h. How to evaluate students	V	M	S	N	D
i. Support from administration	V	M	S	N	D
j. Support from faculty	V	M	S	N	D
k. "Values" of teaching/learning	V	M	S	N	D

25. If you are interested in teaching part-time at a local community college, what would be your main reason(s) for doing so? *(circle those letters that apply)*

- a. I feel confident that I would be an effective teacher
- b. Personal satisfaction of teaching others
- c. Income
- d. It would help my career advancement
- e. I want to be part of an academic environment
- f. It might be enjoyable
- g. My expertise helps strengthen the *community*
- h. Teaching others would help my *company*
- i. I like the variety in my life
- j. Other _____

26. If you do NOT want to teach part-time at a local community college, why not?
(circle the letters that apply)

- a. Lack confidence about my ability to teach
- b. Lack confidence in speaking in front of others
- c. Lack confidence in my professional (engineering) abilities
- d. Not enough time
- e. Not interest in teaching
- f. My full-time work is too demanding
- g. Poor health
- h. Too many other commitments
- i. Does not pay enough
- j. May move out of the area
- k. Other: _____

Survey Complete - Thank You!

**Please return this survey to Bill Shelton,
Human Resource Development Manager**

© David E. Smith
Oregon State University School of Education

Appendix B

“From Silicon to Chip”

"From Silicon to Chip"



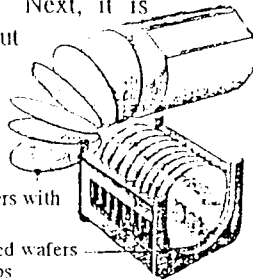
The soaring worldwide demand for microchips - used in everything from hair dryers to computers - has fueled the Portland area's high-tech boom. Semiconductor companies will need thousands of workers over the next five years to help meet the demand. Here's how workers turn silicon into chips:

1 Silicon used by the semiconductor industry comes from the Earth's crust. Workers grow a pure silicon rod - called an ingot - by heating silicon crystals in a furnace.

Pure silicon rod

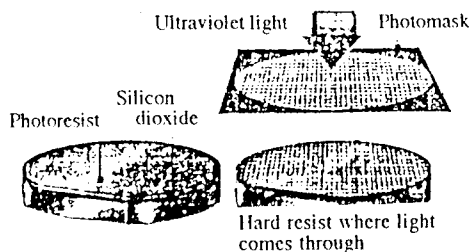


2 Using high-tech machines, the silicon rod is shaped into a perfectly rounded cylinder weighing from 10 to 200 pounds. Next, it is sliced into thin wafers about the size and thickness of a compact disc. They are then cleaned and polished.



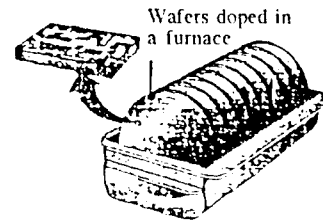
Rod sliced into wafers with a diamond saw

Clean, polished wafers ready for chips

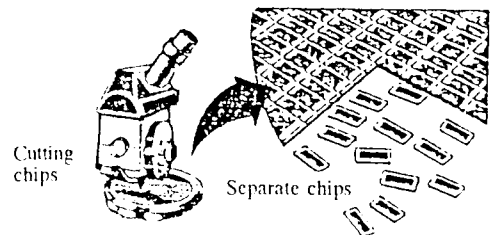


3 Chips in a pattern of circuitry are etched onto the wafer through a series of photographic processes that involve gases and light sensitive material.

Aluminum tracks laid on doped surface



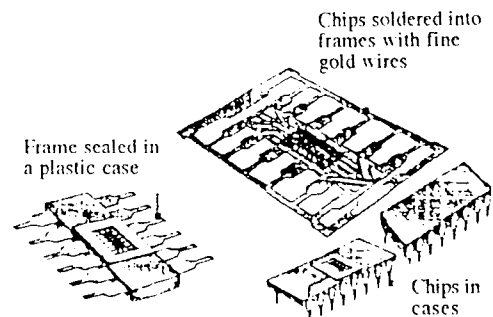
4 Tiny amounts of chemical impurities, called dopants, are either heated or electrically beamed onto the surface of the wafer, giving it positive and negative charges. The location of these charges individualizes one chip from another.



Cutting chips

Separate chips

5 The wafer is cut into separate, identical chips. A six-inch wafer, for example, holds about 80 of Intel's Pentium chips.



Chips soldered into frames with fine gold wires

Frame sealed in a plastic case

Chips in cases

6 A speck of dust can ruin a chip, so they are tested with electrical probes. Those that work are attached to a frame and sealed in a plastic case.

(Source: Jackson as cited in Crockett, 1995, A14)

Appendix C

Job Descriptions of Respondents

Semiconductor Workforce Matrix - Composite Position Briefs

General Job Classifications of Survey Respondents:

EQUIPMENT ENGINEER

MANUFACTURING ENGINEER

PROCESS ENGINEER

QUALITY ASSURANCE ENGINEER

TEST ENGINEER

Source: Semiconductor Workforce Consortium (1995)

EQUIPMENT ENGINEER

General Job Duties
<p>Maximizes the availability and productivity of the equipment in an assigned area by designing and implementing corrective and preventive maintenance procedures. Responsible for projects related to replacement, repairs and improvements in manufacturing equipment. Provides technical and analytical support to the operation and maintenance of manufacturing processes and products. Acts as a resource to assist equipment maintenance technicians in the completion of complex equipment repairs. Provides training to equipment maintenance technicians. Implements equipment modifications to maximize equipment availability.</p>
Knowledge, Skills, and Abilities
<ul style="list-style-type: none">• Ability to recognize deviations from accepted parameters and provide countermeasures to correct the nonconformance.• Ability to develop, review and modify equipment, preventive maintenance procedures and specifications.• Strong teamwork, communication and formal presentation skills are required.• Ability to troubleshoot assigned equipment to component level.• Ability to monitor equipment parameters and make recommendations to correct nonconformance.• Working knowledge of wafer or semiconductor manufacturing methods and theory.
Required Education and Experience
<p>Bachelor's degree in electrical or mechanical engineering, physics or related science, or the equivalent in training and experience.</p>

PROCESS ENGINEER

General Job Duties
<p>Provides in-depth technical support for complex semiconductor fabrication activities, processes, products, and equipment. Responsible for coordinating and performing adjustment on processing equipment to optimize processes. Uses statistical techniques to evaluate processes and test performances. Develops, reviews, and modifies process specifications. Monitors production technician and operator performance, cleanroom procedures and equipment operation.</p>
Knowledge, Skills, and Abilities
<ul style="list-style-type: none">• A high level of mathematics and a working knowledge of statistical process control techniques and methods.• The ability to recognize deviations from accepted parameters and provide countermeasures to correct the non-conformance.• Strong teamwork, communication and formal presentation skills are required.• Ability to coordinate and perform all activities required for initial justification and successful implementation of new processes or processing equipment.• Computer keyboarding and word processing are required. Able to use databases or statistical process control programs to monitor processes or equipment parameters.
Required Education and Experience
<p>Bachelor's degree in a physical science or the equivalent experience/training in a technical or scientific area of study.</p>

QUALITY ASSURANCE ENGINEER

General Job Duties
<p>Develops, implements, and administers quality programs to ensure compliance with established company and customer standards and specifications. Provides guidance and support to Quality and Reliability support groups, manufacturing areas and vendors in making quality-related decisions or recommendations. Collects and analyzes process data to ensure conformance to manufacturing specifications.</p>
Knowledge, Skills, and Abilities
<ul style="list-style-type: none">• A high level of mathematics and a working knowledge of statistical process control techniques and methods.• The ability to recognize deviations from accepted parameters and provide countermeasures to correct the non-conformance• Strong teamwork, communication and formal presentation skills are required.• Computer keyboarding and word processing are required.• Ability to use databases or statistical process control programs to monitor processes or equipment parameters.• Demonstrated quality assurance practices and techniques.
Required Education and Experience
<p>Bachelor's degree in semiconductor processing, statistics, chemistry, physics, electrical engineering, or the equivalent in training and experience.</p>

TEST ENGINEER

General Job Duties
<p>Provides technical support for a variety of complex, semiroutine wafer or semiconductor testing activities requiring a knowledge of testing standards and the ability to recognize deviations from accepted parameters. Provides engineering support on wafer or semiconductor testing equipment to include setups, recalculations of settings and clearing of machine or process problems. Processes test runs and documents results to meet product specifications and quality standards. Performs tests for new processes and products.</p>
Knowledge, Skills, and Abilities
<ul style="list-style-type: none"> • Ability to recognize deviations from accepted parameters and provide countermeasures to correct the non-conformance. • Ability to develop, review and modify test equipment, procedures and specifications. • Strong teamwork, communication and formal presentation skills are required. • Ability to monitor equipment parameters and make recommendations to correct nonconformances. • Working knowledge of wafer or semiconductor manufacturing methods and theory. • Working knowledge of processing specifications and requirements.
Required Education and Experience
<p>Associate degree in microelectronics, chemistry, physics, electronics or other related area or the equivalent in training and experience.</p>

Appendix D

Transmittals

From: David E. Smith

1330 No. Albany Rd. • Albany, OR 97321

Fax: (503) 924-9026 • Phone: (503) 924-9010

Message To: Dennis Maas, c/o Siltec Silicon

Fax (503) 371-0406

Company: Semiconductor Workforce Consortium

Phone: (503) 361-3452

No. of Pgs: 3

Date: 9/8/95

Message: As promised, here is my executive research summary. This study will help industry and community colleges increase the pool of qualified technical instructors for the semiconductor industry.

I am looking forward to meeting with you and other Consortium members during your September meeting. My presentation should take about ten minutes with a brief question and answer period, if requested by your members.

Please confirm my inclusion in your September agenda, with date, time, and location. I have a few overhead transparencies I'd like to share, so an on-site overhead projector would be helpful.

Cordially,

David E. Smith

Ph.D. Candidate

Oregon State University

Increasing the Pool of Part-Time Technical Faculty at Community Colleges: The Importance of Self-Efficacy in Recruiting Technical Specialists from the Semiconductor Industry.

Problem. There are current and projected shortages of qualified instructors in many areas of occupational education. This is especially evident in emerging technologies, such as the semiconductor industry. Replacing and adding faculty in these areas is particularly challenging for community colleges as they increase their pool of technical instructors. Several variables can influence decisions in creating a pool of qualified applicants for technical instructor positions. Although the decision basis for replacing and adding faculty is complex, qualified technical specialists from industry appear to be a good teaching resource.

Methodology. This study will identify and analyze the importance of self-efficacy as technical specialists consider teaching part-time at community colleges. A survey instrument will question a volunteer population of technical specialists from semiconductor manufacturers located in Oregon. Major survey categories will include: 1. Demographics of potential part-time instructors, 2. Teaching/training experience, 3. Awareness of part-time teaching potential at community college, and 5. Identify barriers to teaching.

How the Consortium Can Help. 1. Provide a letter of authorization in support of the project. 2. Request the cooperation of participating companies by asking them to provide survey participants. 3. Provide a contact from each participating company to be the liaison.

Benefits to the Consortium. 1. Increase the pool of qualified technical instructors by identifying experienced specialists who know industry processes. 2. As possible barriers of recruitment of part-time instructors are identified, industry and community colleges can act to remove those barriers.

Background. By end of the 1990s, nearly 75% of U.S. jobs will require postsecondary education for job entry. The community college plays a significant role in producing a qualified workforce for job entry and reentry. To meet the challenges of workforce

preparation, these institutions must provide current, relevant programs in occupational and technical education. Because of the need for industrial relevancy, many technical instructors will teach part-time while working full-time in industry.

The dramatic expansion of the semiconductor industry in Oregon is placing an additional burden on workforce preparation and instructional staffing. In the Portland area alone, the value of pending and potential semiconductor chip and wafer plants exceed \$10 billion. Within the next five years, this industry will create an estimated 7,500 new jobs in Oregon. A major challenge for educators is to effectively train technical specialists to meet the unique needs of this industry.

As the demand for qualified technical instructors grows, many community colleges will invite experienced technical specialists to teach for their institutions. However, they often overlook perceptions of candidate motivation and teaching ability. Such perceptions normally occur before accepting a teaching position and may influence the decision to teach part-time and the ability to teach effectively. For example, after technical specialists have gained experience on the job, do they perceive themselves as possible candidates for teaching their skills to others? Do they want to teach part-time at a community college? Can they assume the role of teacher? How does self-efficacy, or their belief about their capabilities, influence such decision? Answers to these questions are helpful to community colleges and the industries they serve as they strive to increase their pools of qualified technical instructors.

Theoretical Framework. The theoretical framework of this recruitment concept draws upon an integration of Bandura's seminal work on self-efficacy and Hackett and Betz's adaptation of Bandura's theory to career development. A careful examination of self-efficacy of workforce professionals will enable researchers to better understand unique recruitment needs of community colleges and part-time instructors from industry.

From: David E. Smith

1330 No. Albany Rd. • Albany, OR 97321

Fax: 924-9026 • Phone: 924-9010

Message **To: Bill Shelton**

Fax: (360) 260-7687

Company: **SEH America, H/R Education**

Phone: (360) 254-3030

No. of Pgs: 9

Date: 1/22/96

Message: Phone request for survey approval

Dear Bill,

Here is the survey we discussed last Thursday afternoon. As you recall, the Semiconductor Workforce Consortium supported this study and indicated its importance to the industry. *This survey will be used to find out how we can increase the number of qualified technical instructors in the semiconductor industry.* My main objective is to identify barriers that affect the decision of your engineers and technical managers in this area to become part-time technical instructors for a community college, such as PCC. This survey can also be used to find out how much interest there is for teaching in-house for SEH America.

There is nothing in the survey that would jeopardize your proprietary information. The demographic data are useful as they provide additional pieces to the puzzle which might uncover the barriers in finding and recruiting potential instructors. The survey should only take about six minutes to complete. The actual survey will be printed "back-to-back" for a less cumbersome format. The more respondents, the better. Respondents from different shifts are okay. A good representation would be at least 75 returns or more.

In order to facilitate a better response rate, an SEH cover letter will be helpful. You might consider page 3 of this fax as a possible cover letter format. I can have the cover letter printed at my expense and have it attached with the survey, ready for distribution.

Please give me a call after you get a chance to review the survey. I'd like to meet with you and talk about how we can best accomplish getting the survey to your engineers and technical managers without disrupting their work. Thanks for your help!

Kind regards,

David E. Smith,

Oregon State University

02-12-1996 09:44AM FROM: SEH-QUERICO-HumanResource TO: 150392430263 2546373

ShinEtsu

SEH-A INTEROFFICE MEMO

TO:

DATE: February 12, 1996

cc:

FROM: B. Shelton

SUBJECT: EDUCATIONAL SURVEY

David Smith, an Oregon State University doctoral student, has asked for our help. He is conducting a survey to identify barriers that influence the decision of engineers and technical managers to teach at community colleges or in their companies.

There is nothing in this survey that involves SEH proprietary information nor is this survey meant to describe a position or indicate SEH support regarding teaching on-site or at a local community college. Completion of the survey is optional, however, your participation is appreciated.

Please take about 5 minutes of your time to complete this survey and return it to me by February 26, 1996. Thank you.

SHARP

SHARP MICROELECTRONICS TECHNOLOGY, INC.

5700 NW Pacific Rim Boulevard
Camas, Washington 98607

Telephone (360) 834-8700
Facsimile (360) 834-8611

November 13, 1995

Dear SMT Employee:

David Smith, with the Oregon State University School of Education, has asked for our help. He is conducting a survey with the objective of identifying barriers that affect the decision of engineers and technical managers to become part-time technical instructors for local community colleges.

There is nothing in this survey that will jeopardize SMT proprietary information, and the demographic data is useful as it provides additional pieces to the puzzle which might uncover the barriers in finding and recruiting potential instructors.

Completing this survey is optional, but we would appreciate your feedback. If you are willing to help, it will only take five minutes of your time. Please return the completed survey to me by November 28.

Thanks for your help.

Redacted for privacy

Kelli Ambuehl
Manager, Training and Resource Development
360-834-8639

SHARP

SHARP MICROELECTRONICS TECHNOLOGY, INC.

5700 NW Pacific Rim Boulevard
Camas, Washington 98607

Telephone (360) 834-8700

Facsimile (360) 834-8611

November 29, 1995

David Smith
1330 North Albany Road
Albany, OR 97321

Dear David,

Enclosed are the returned surveys. I distributed 110 and received 23 back as of 11/28/95. That is a 21% return rate -- pretty good for a survey of any kind. I hope the information is of help. Good luck to you in your project.

Sincerely,
Redacted for privacy

Kelli Ambuehl
(360) 834-8639

OFFICE
OF
DEAN OF RESEARCH



OREGON
STATE
UNIVERSITY

312 Administrative Services
Corvallis, Oregon
97331-2140

541-737-0670
FAX: 541-737-3093
INTERNET
nunnm@ccmail.orst.edu

January 30, 1996

Principal Investigator:

The following project has been approved for exemption under the guidelines of Oregon State University's Committee for the Protection of Human Subjects and the U.S. Department of Health and Human Services:

Principal Investigator(s): Sam Stern

Student's Name (if any): David E. Smith

Department: Education

Source of Funding:

Project Title: Increasing the Pool of Part-Time Technical Faculty at Community Colleges: Identifying the Barriers...

Comments:

A copy of this information will be provided to the Committee for the Protection of Human Subjects. If questions arise, you may be contacted further.

Sincerely,

Redacted for privacy

Mary E. Nunn
Sponsored Programs Officer

cc: CPHS Chair

Appendix E

Instructions to Panel of Experts

October 12, 1995

To: Panel of Experts on Self-Efficacy and Community College Part-Time Instructors:

- | | |
|---------------------|--|
| • Kelli Ambuehl | Sharp Microelectronics Technology, Inc. |
| • Ronald Daugherty | Western Center for Community College Development |
| • Thomas Fahey | OKI Semiconductor |
| • Gail Hackett | Arizona State University |
| • Cheryl Hinerman | Intel Corporation |
| • Robert W. Lent | Michigan State University |
| • Gary Miller | Hewlett Packard Company |
| • Donald O. Prickel | Oregon State University |
| • William Shelton | SEH America, Inc. |
| • Sam Stern | Oregon State University |

From: David E. Smith

RE: Critique of survey used in study: Increasing the Pool of Part-Time Technical Faculty at Community Colleges: The Importance of Self-Efficacy in Recruiting Technical Specialists from the Semiconductor Industry

Thank you very much for your support. As promised, here is the survey prototype for your review and critique. For clarification, I have included a summary of this study. After reading this summary, please provide comments to the survey per instructions. Your suggestions will be most helpful in designing an effective survey instrument for this study. My intent is to help industry and community colleges increase the pool of qualified technical instructors from the semiconductor industry.

I know you have busy schedules but trust you will return the survey prototype within two weeks of receipt of this document. Our collective and collaborative efforts on self-efficacy in career decision-making will contribute to a clearer understanding on this important subject.

Cordially,

David E. Smith
Ph.D. Candidate
Oregon State University

Directions to the Panel of Experts:

To evaluate the contents of the instrument to be used to collect data for this study, you, as a member of the Panel will critique the survey that follows.

1. Your first task is to provide general comment for the directions to participants and questions 1-11 (demographic data).
2. Next, evaluate questions 12-24 on the basis of the underlying premises of self-efficacy as they relate to the career decision making process, listed below (Bandura, 1977; Hackett & Betz, 1981; Lent, Brown, & Hackett, 1994). One or more of these premises should be met to determine whether a question is addressing self-efficacy. These premises provide the theoretical support and methodological direction for the development of this study:
 - a. Factors of attention, expectancies, and beliefs play an important role in the acquisition of new behavior.
 - b. People who perform poorly may do so because they either lack the skills or have the skills, but lack the efficacy to use them.
 - c. Self-efficacy influences choice of activities, the amount of effort expended, and persistence in the face of obstacles.
 - d. Self-efficacy has been proven to be a better predictor of success in the performance of an activity than actual innate ability.
 - e. Self-efficacy is a construct found effective in altering avoidant behaviors.
 - f. Self-efficacy is applicable to other disciplines of human behavior.
 - g. The theory of self-efficacy is best applied to domain-specific contexts, such as making the decision to extend one's career from the technical workforce to teaching those same skills to others.

Your responses to questions 12-24 are located in the box below each question, for example: Does #12 address an underlying premise(s) of the self-efficacy?

a. ☐ yes b. ☐ no

If "yes", how would rephrase this question? _____

If "no", how would you reword this question to support an underlying premise of self-efficacy? _____